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A NEW SPECIES OF AMPHIZOA (COLEOPTERA)

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During the summer of 1925, while the guest of Mr. Merton C. Lane of Toppenish, Washington, I was shown a peculiar *Amphizoa* which had been received from Idaho. It had the disk of the elytra quite flattened and presented other features which seemed to place it apart from our other species. Inasmuch as it was a unique and there were possibilities that it might be an abnormal specimen, it was felt that it should not be described. Recently, however, I have received a series of specimens from Mr. F. S. Carr of Medicine Hat, Alberta, Canada, which are similar to the one previously noted and constant enough as to character to prove that we have a new species. This I was requested to describe.

Key for the Separation of the American Species of Amphizoa Lec.

Elytra evenly convex.

Color black, prothorax broadest at middle, elytra very irregularly and coarsely rugose especially at sides, average length 12 mm. Alaska, British Columbia, through Cascades and High Sierra Nevada Mountains to Mount San Bernardino, California ..... *insolens* Lec.

Color somewhat brownish, prothorax broadest at base, elytra finely rugose, almost smooth, average length 15 mm. British Columbia, northern Cascades and Yellowstone Park..... ..... *lecontei* Matth.

Elytra flattened on disk, color dirty brown to black, prothorax broadest at base, elytra somewhat smooth at middle, rugose at sides, average length 12-13 mm. Mountains of Idaho and western Alberta..... *planata* sp. nov.

Amphizoa planata Van Dyke, new species

Similar in size to *insolens,* dirty brown to black in color, disk of elytra flat, the sides declivous. Head with front shallowly, longitudinally bisulcate, occiput finely, sparsely punctate, eyes not prominent, flatter than in *insolens*; antennæ extending to near hind angles of prothorax, third segment distinctly more than twice as long as broad and much narrowed basally, outer segments all at least one and a half times as long as broad. Prothorax twice as broad as long, much narrowed in front, apex deeply emarginate, anterior angles acutely produced, more acute than in either *insolens* or *lecontei,* base truncate, sides slightly sinuate in front of hind angles, rounded at middle and almost straight and convergent to front angles, the lateral margin irregularly crenulate, the disk somewhat flattened, broadly longitudinally impressed at middle, depressed laterally and rather finely, sparsely punctate at center and granulate rugose laterally. Elytra broadly rounded at humeri, almost parallel at middle and gradually arcuately narrowed to apex, the disk from suture to fifth interval slightly elevated and decidedly flat, externally shallowly sulcate to margin, the sutures observable though poorly impressed and indistinctly punctate, the fifth interval prominent in front, the median intervals flattened anteriorly, the lateral slightly convex and granulate, especially posteriorly, the general surface dull and opaque. Length, 13 mm.; breadth, 7 mm.

Holotype (No. 2453, Mus. Calif. Acad. Sci.), and three paratypes in my collection and three paratypes in the collection of Mr. F. S. Carr of Medicin Hat, Alberta, Canada. These were all collected by Mr. Carr, four including the type from **Beaver Creek, Alberta,** May 22, 1916; two at Lunbreck, Alberta, August 8, 1925; and one at Michel Lake, British Columbia, August 10, 1926.

This species is in general of the same size as *Amphizoa insolens* Lec., but differs in many regards: color, sculpturing, length of antennæ (much shorter in *insolens*), shape of prothorax and transverse outline of elytra. It strongly suggests *Amphizoa lecontei* Matth. and was at first considered to be but a subspecies of that, for the general color and the shape of the prothorax are alike, but it differs by being smaller, by having slightly longer antennæ, by being duller in appearance and more rugose, with the elytral intervals more evidently elevated posteriorly and the disk of the elytra flat.

NEW SPECIES AND SUBSPECIES OF WEST AMERICAN CERAMBYCIDÆ (COLEOPTERA)

BY EDWIN C. VAN DYKE
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Oeme hirsuta Van Dyke, new species

Elongate, slightly flattened, rufo-castaneous and clothed with a moderately dense fine pile, the elytra with a series of scattered, more erect and longer setæ in addition, the under surface of the antennal segments 3-6 fringed with long flying hair, and the legs decidedly hairy. Head moderately coarsely closely punctured and pilose, broadly longitudinally sulcate between the antennæ and evidently flattened behind and between the eyes; eyes large, coarsely granulate and deeply emarginate as usual; antennæ long, reaching four segments beyond apex of elytra in male, first segments very stout and long, reaching beyond anterior third of prothorax and fully two-thirds length of third, segments 3-5 inclusive with small acute tubercles beneath. Prothorax a little wider than long, apex distinctly arcuate, base slightly emarginate, sides divergent from apex and at basal fourth suddenly tubularly constricted, angles in front of the constriction broadly rounded, constriction deepened by a transverse sulcus, disk rather coarsely, closely and irregularly punctured, with a median smooth longitudinal line, barely impressed. Elytra near base barely wider than thorax and four times as long, surface finely closely punctured, with series of larger shallow punctures irregularly dispersed and three feebly elevated lines on each. Body beneath finely, more sparsely punctured and shining. Length, 14.5 mm.; breadth, 2.5 mm.

Males, in addition to the longer and more robust antennæ and broader prothorax, have the last ventral segment somewhat truncate and notched at apex.

Females with antennæ barely reaching beyond apex of elytra, basal segments less robust, acute spines on segments 3-5 hardly evident; prothorax much smaller and less broad and as a result not so suddenly constricted behind; the last ventral segment elongate and arcuated at apex.

Holotype, male, No. 2439, and allotype, female (No. 2440, Mus. Calif. Acad. Sci.), in the Van Dyke collection, and several designated paratypes from a series of seventeen specimens taken at light on **Mount Washington,** near **Nogales, Arizona,** altitude 6000 feet, on various dates from July 11-20, 1919, by Mr. J. Aug. Kusche. A specimen from the Huachuca Mountains, Arizona, is also in my collection.

This species superficially very closely resembles *Oeme rigida*

(Say), but it differs by being more definitely pilose, with a more evident double type of elytral punctuation and pubescence; the head and prothorax more coarsely punctured, the former more flattened between the eyes in the occipital area, the basal antennal segment more robust and longer, in *rigida* barely longer than one-half of third segment, and the disk of the pronotum with a very distinct smooth longitudinal line which is hardly impressed, whereas in *rigida* there is no distinct smooth area but a well-marked longitudinal impression. *O. gracilis* Lec. is more piceous, far less pilose, with more evenly rounded prothorax, less suddenly constricted behind, coarse and very conspicuous pronotal punctuation and much sparser elytral punctuation. From our other species, it is readily separated by the characters given by Doctor Horn [1] in his review of the species.

Styloxus ruficeps Van Dyke, new species

Delicately formed and elongate, subcylindrical; pitchy black, legs lighter, entire head except the eyes rufous. Head broader across the front than long, front prominent, with a narrow longitudinal line slightly impressed forward, more deeply between the antennæ, antennal tubercles prominent and widely divergent, almost horizontal; eyes very large, coarsely faceted, approximate above, deeply sinuate in front, and separated beneath by narrow gular area, one-fourth the breadth of head; antennæ very long and attenuated, about twice as long as from front of head to apex of elytra, first segment with an obtuse spine above, second very short, following very long and cylindrical, the basal joints with a few long hairs beneath. Prothorax almost twice as long as broad, with small tubercles at sides behind the middle, rugosely punctate above, with series of callosities in the form of a circle on the posterior area. Elytra about a fourth broader than prothorax and as broad as head, almost four times as long as prothorax yet not covering the last three abdominal segments nor the apices of the wings, with straight sides, slightly convergent posteriorly, each elytron individually rounded, the disk rather coarsely irregularly punctured, with an indistinct carina at middle of each elytron, and rather finely sparsely pilose. Legs long and delicate, femora slightly clavate, first tarsal segment of hind pair equal to the two following combined. Beneath rather finely sparsely punctured and pilose and shining. Length 9.5 mm. to apex of elytra, abdomen 2.5 mm. longer, breadth 1.75 mm.

Holotype, male, in the Van Dyke collection (No. 2441, Mus. Calif. Acad. Sci.), taken on **Mount Washington,** near **Nogales,**

[1] Trans. Am. Ent. Soc., Vol. VIII (April, 1880), p. 133.

Arizona, altitude 600 feet, July 20, 1919, by Mr. J. Aug. Kusche, and kindly presented to me.

From *Styloxus lucanus* Lec. from Lower California, the type of the genus and the only other species described, this species appears to be quite distinct, not only in color but because of the greater length of prothorax and practically contiguous eyes above. The genus *Idoemea* Horn is much more closely related to *Styloxus* Lec. than is generally supposed, the longer head and longer elytra of the former being the only really evident characters which separate it, a fact which I think would warrant the two being united. *Malthophia oculata* Casey, I am convinced is nothing but a small specimen of *Idoemea californica* Fall. I have compared specimens from San Diego, California, the type locality of the former, which agree exactly with the description and with typical specimens of the latter, including a specimen sent to me by Mr. Fall himself.

Centrodera pilosa Van Dyke, new species

Elongate, slender, subparallel, very densely pilose; rufo-piceous, legs and basal portion of antennal segments rufo-castaneous. Head rather finely closely punctured and clothed with rather long cinereous pile, finely impressed longitudinally at middle; eyes prominent, coarsely faceted and separated above by diameter less than one-third of transverse diameter of head; antennæ slender, reaching almost a segment beyond apex of elytra, the outer two-thirds of segments 5-11 darker (black in paratype), fourth segment twice as long as second, fifth as long as 2-4 combined. Prothorax almost a third longer than broad, strongly constricted in front and almost as much so behind, lateral tubercles obtusely angulated, disk rather finely closely punctured, median longitudinal line smooth and nonimpressed, a small tubercle on either side in front of middle, the surface clothed as is the head with rather long cinereous pile. Elytra not quite twice as wide at base as prothorax, almost three times as long as head and prothorax combined, with sides almost straight and very slightly convergent to hind angles which are rounded; disk finely, sparsely and somewhat irregularly punctured, with vague sulci and clothed with rather long somewhat depressed cinereous pile. Beneath clothed as above. Hind tarsi with basal segment about three-fourths length of following segments united. Length, 16 mm.; breadth, 4 mm.

Holotype (No. 2442, Mus. Calif. Acad. Sci.), a supposed male, collected in the Sierra Madre Mountains of **Los Angeles County, California,** June 2, 1922, by Mr. J. Aug. Kusche, and now in my collection. A second specimen belonging to Dr. F. E. Blaisdell which is quite similar in structure and appearance

though somewhat darker and with outer portions of the antennal segments quite black, I have designated as a paratype. It was taken in the Cuyamaca Mountains of San Diego County, California, June 8-21, 1920.

This gray species, because of its extreme pilosity, contrasts markedly with our other Pacific Coast species and should thus be easily recognized.

Centrodera blaisdelli Van Dyke, new species

Elongate, slender and delicately formed; rufo-castaneous, head and prothorax darker and more rufous, legs and antennæ lighter, the outer portion (less than one-half) of segments 5-10 black and the terminal with black band near the apex; surface sparsely clothed with short and fine closely appressed gray hair. Head small, closely, finely and rugosely punctured, finely impressed longitudinally at middle; eyes prominent, coarsely faceted and separated above by a distance less than one-third of transverse diameter of head; antennæ slender, reaching just beyond apex of elytra, fourth segment three times as long as second which is barely longer than broad, fifth barely as long as three and four combined. Prothorax slightly longer than broad, strongly constricted toward front and much less so behind; lateral tubercles obtuse and rounded at apex; disk somewhat finely, closely punctured and subopaque as a result, distinctly sulcate at middle, the depression bounded laterally by elliptical tubercles, convergent anteriorly; surface clothed with evident though sparse cinereous pubescence. Elytra almost twice as wide at base as prothorax, two and a half times as long as head and prothorax combined; sides straight and convergent to rounded hind angles; the disk quite coarsely, closely punctured basally and rapidly more finely punctured toward apex, clothed with fine, short and sparse pubescence. Beneath sparsely, finely pilose. Hind tarsi with basal segment equal to following segments united. Length, 16 mm.; breadth, 4 mm.

Holotype (No. 2443, Mus. Calif. Acad. Sci.), a unique, collected in the **Cuyamaca Mountains** of **San Diego County, California,** June 8-21, 1920, and now in the collection of Dr. F. E. Blaisdell.

This species can be readily separated from our other Pacific Coast species by its rufo-castaneous color, its delicate form, very short and sparse pubescence and sulcate prothorax.

TABLE FOR SEPARATION OF PACIFIC COAST SPECIES OF CENTRODERA

Elytra coarsely, closely punctured near base and finely sparsely

pubescent, basal segments of hind tarsi equal to following segments united.

Prothorax as broad as long, disk only sulcate toward front; body robust, color chocolate brown. Northern California, western Nevada.....*nevadica* Lec.

Prothorax longer than broad, disk distinctly sulcate throughout median area; body narrow and delicate, rufo-castaneous. Mountains of southern California.....*blaisdelli* spec. nov.

Elytra rather finely, sparsely punctured even at base, distinctly pubescent, basal segment of hind tarsi not equal to following segments united.

Surface but moderately finely and sparsely pilose, color reddish brown. San Diego, California.....*tenera* Casey

Surface densely, rather coarsely pilose, color rufo-piceous. Mountains of southern California.....*pilosa* spec. nov.

Colonel Casey's *oculata* is an undoubted *nevadica*. His type of *tenera* was probably a depauperized male. In Doctor Blaisdell's collection there is a large female, 18 mm. long, from the type locality, San Diego, California. In this specimen the eyes are much more widely separated than they are in the males. *Nevadica* breeds in western yellow pine, *Pinus ponderosa* Don., and the probabilities are that the other species also breed in pine or related coniferous trees.

Semanotus [2] ligneus thujæ Van Dyke, new subspecies

This subspecies or variety resembles in size and general form the variety *ampla* Casey. It differs otherwise, however, by having the elytra more finely and closely punctured and by possessing a different color pattern. Whereas *ampla* is quite constant as regards its markings, resembling in this respect the typical form of the eastern part of the country, *thujæ* is decidedly unstable. The body is black and the elytra a bluish black ornamented with orange, the amount of the orange varying from the forms with maximum coloration where there are two transverse orange bars, the anterior somewhat back from the base, the posterior slightly behind the middle and both connected by narrow bands along the suture and lateral margins, to the forms with minimum ornamentation where there is but a tiny yellow spot on the disk back of the base and a slight yellowing along the anterior epipleuræ. In the more fully marked individuals, the antennæ except the basal segments and the tibiæ and tarsi are also rufous while in the darker phases, often only the tarsi are rufous. The most characteristic feature of the variety is that the base of the elytra is always black, whereas in all other varieties the base is an orange yellow. In this latter peculiarity and, in fact, in its general color pattern and

2 For a discussion of the members of this genus see a former article by me in Bul. Brooklyn Ent. Soc., Vol. XVIII (1923), pp. 48-51.

great variability, it resembles a related species, *Semanotus nicolas* White (*litigiosus* Casey), but it differs from this otherwise by being much less hairy, by having the elytra in the main a bluish black color instead of a coal black, and by having a different type of punctuation. Its food plant is also one of the cupressine trees, the red cedar, *Thuja plicata* Don., as is the case with all other phases of the species, whereas *nicolas* breeds either in the true firs, *Abies,* or true spruces, *Picea.*

Holotype, male, No. 2444, and allotype, female, No. 2445, Mus. Calif. Acad. Sci., the first a specimen with maximum orange coloration, the second with minimum amount of orange, and four paratypes, in my collection. There are also a number of designated paratypes in the rest of the series of twelve specimens, all of which were collected by Mr. G. A. Hardy in **Vancouver Island, British Columbia.** Most of the specimens were taken at Tod Inlet, from the pupal cells in red cedar, *Thuja plicata* Don., on December 5, 1925. For the privilege of studying these I am indebted to Mr. Hardy.

Callidium vancouverense Van Dyke, new species

Moderately elongate, parallel-sided, flattened; body black, front of head, basal antennal segment, prothorax, both above and beneath, and elytra dark greenish blue, legs with a bluish cast; upper surface somewhat shining. Head slightly more than one-half breadth of prothorax, coarsely reticulately punctured, most pronounced behind the eyes, median line finely impressed; antennæ moderately robust, in male extending to last quarter of elytra, second segment about twice as long as broad and third almost four times as long as broad and twice as long as second. Prothorax twice as broad as long, just perceptibly narrower than elytra, sides broadly rounded, more evenly in front and more obliquely behind, disk with sides finely, deeply, closely and reticulately punctured, the median area with an amphora-like depression which is more shining and more coarsely, shallowly and sparsely punctured than the sides, the surface rather sparsely clothed with short, suberect black hair. Elytra twice as long as broad, parallel-sided, gradually obliquely rounded to apex, humeri prominent, disk very coarsely, deeply, irregularly and cribrately punctured, with a short black obliquely inclined seta arising from each puncture. Abdomen beneath somewhat smooth and shining and finely sparsely punctured and pubescent. Legs with femora markedly pubescent and suddenly clavate, those of the middle and hind pairs with the basal shank cylindrical almost to the middle. Length, 13 mm.; breadth, 5 mm.

Female with antennæ shorter than in male, reaching barely beyond middle of elytra; prothorax smaller and proportionally narrower; femora less clavate and hind tibiæ straighter.

Holotype, male, No. 2446, and allotype, female, No. 2447, Mus. Calif. Acad. Sci.), and four paratypes, in my collection, as well as numerous paratypes in the collection of Mr. G. A. Hardy of Victoria, British Columbia, and Mr. W. H. A. Preece of Sidney, British Columbia. These are from a series of thirty-four specimens kindly submitted for study by the gentlemen named. The majority of the specimens were reared by Mr. Preece from boughs of Douglas fir, *Pseudotsuga taxifolia* Britt., collected at **Sidney, British Columbia,** during the months of April and May, 1926. The series shows considerable variation as to both size and color, ranging in length from 9-15 mm. and in color from greenish blue to blue and violet.

This species is of the same size and general form as *Callidium antennatum* Newm., particularly of the western variety, *hesperum* Casey, and very closely resembles it, especially the bluer specimens. It differs from it by being in general of a greener cast, though many are as pronounced a blue; by the much finer, deeper and more distinctly punctured sides of the pronotum; the coarser and deeper punctures and reticulation of the elytra; and the more suddenly clavate femora. It also quite closely resembles *Callidium subopacum* Swain,[3] especially the greener forms, because of the coarse elytral sculpturing, but it differs by having much more robust antennæ, the sides of the prothorax more deeply and finely punctured, and the femora, particularly in the males, more suddenly and broadly clavate. From the Californian *Callidium pseudotsugæ* Fisher [4] which has the same food tree, it differs by being more elongate, by not possessing the black or bluish black color, by having slightly shorter antennæ, more deeply punctured sides of prothorax and coarser and more irregular elytral reticulation. *Callidium antennatum* var. *hesperum* Casey, like the typical eastern form, is in the main restricted to pines, but rarely breeding in other coniferous trees. *Callidium subopacum* Swain, no doubt, breeds in the true spruces or possibly the true firs, whereas all of our other large western bluish species breed in the juniper with the exception of one which lives in the giant sequoia.

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3 Report of the Canadian Arctic Expedition, 1913-1918, Vol. III, Insects, Part E. Coleoptera, J. M. Swain (December 12, 1919), p. 12E.

4 A New Genus and Several New Species of Cerambycidæ (Coleoptera), by W. S. Fisher. Proc. Entom. Soc. Wash., Vol. 22, No. 7 (October, 1920), pp. 155-156.

Neoclytus basalis Van Dyke, new species

Elongate, subcylindrical, moderately robust; rufous, pronotum brownish, margined anteriorly and posteriorly with narrow bands of yellow hair, elytra brown with three transverse bars of yellow pile arranged as follows: a broad basal band occupying more than one-fourth of basal area and extending transversely from margin to margin, a postmedian band, broad at suture and rapidly narrowing toward margins, and a subapical of moderate breadth extending obliquely backward and outward from the suture on either side and, like the postmedian, not quite reaching the lateral margin, underside sparsely clothed with yellow pile, slightly more abundant at sides. Head rather closely, finely punctate in front and behind, but coarsely punctured just back of antennal tubercles, moderately sulcate between the antennæ; antennæ reaching at least three segments behind base of prothorax, with outer segments considerably enlarged, third segment hardly longer than fourth and segments three and four but little more than three times as long as broad. Prothorax longer than broad, broader at apex than base, greatest breadth anterior to middle; sides rather evenly but not markedly arcuate; disk with longitudinal ridge evident but not well defined; surface rather finely, closely punctured, with series of asperities along summit and at sides, and three evident transverse cristæ, the anterior back of apex, the others postmedian. Elytra almost three times as long, and barely broader than prothorax, about three times as long as broad; sides straight, slightly convergent posteriorly; apices angulate but rounded at tips; disk finely, closely punctate, rather sparsely clothed with brown pile on brown areas and more densely with yellow pile on yellow areas. Beneath somewhat shining. Length, 15 mm.; breadth, 3.75 mm.

Holotype (No. 2448, Mus. Calif. Acad. Sci.), a specimen in my collection from **Spokane, Washington,** collected July 30, 1907, by Davidson. I have also associated with this a smaller specimen, 10 mm. in length, which is more uniformly rufous but has the three characteristic elytral bars, the third differing from the type in reaching the apices, the prothorax also with a faint median transverse bar of yellow hair. This latter was collected at Castle Crags, Shasta County, California, July 26, 1921, by Mr. C. L. Fox.

This species belongs in the group with *balteatus* and *interruptus,* but differs from both by the color pattern, the anterior yellow bars of the elytra being well separated from the basal margin in both of these and by having the third antennal segment not distinctly longer than the fourth. Its prothorax is generally narrower, less cristate and with more rounded sides than is the prothorax of *balteatus,* and its upper surface a dark

brown contrasting with the rest of the body, whereas the color of the latter is more uniform. In *interruptus* the prothorax is broader than long and the ground color black, both above and below.

Neoclytus angelicus Van Dyke, new species

Elongate, subcylindrical; velvety black, legs and antennæ rufopiceous, the terminal segments of the latter darker; pronotum with a narrower band of white hair bordering anterior and posterior margins and a complete transverse band of white hairs across the middle; scutellum white; elytra with three transverse white bands, the first one-fourth distant from base; the second submedian and the third toward the apex, the last slightly oblique, barely touching suture and not reaching the lateral margins; underside with patches of white hair along the posterior pronotal margin, on the meso- and meta-epimeron and lateral posterior margins of ventral segments. Head moderately finely, closely punctured, more coarsely just behind antennæ, giving the surface a granulate appearance, depressed between antennal tubercles; antennæ extending a few segments beyond posterior margin of prothorax, segments 5-11 considerably enlarged, third slightly longer than fourth and almost four times as long as broad. Prothorax as broad as long, base and apex of about equal breadth, sides narrowed in front and back, slightly irregularly arcuate at middle; disk with median and lateral longitudinal ridges well marked, with small transverse rugæ on their summits; surface finely, closely punctured. Elytra barely broader than prothorax and about two and one-half times as long; sides straight, apices subangulate, disk finely, closely punctured. Beneath rather finely, closely punctured and somewhat shining. Length, 10 mm.; breadth, 2.5 mm.

Holotype (No. 2449, Mus. Calif. Acad. Sci.), a specimen in my collection, picked up on the beach at **Santa Monica, California,** during the summer of 1891. A second specimen caught at the same time was submitted to Dr. George Horn and is now in his collection at the Philadelphia Academy of Sciences.

This very attractive species also belongs in the group with *interruptus* and *balteatus,* but can always be readily separated by the distinct white bands. From other western black and white species, it can be distinguished by the transverse nature of the bands and shorter and more markedly clubbed antennæ.

Neoclytus vanduzeei Van Dyke, new species

Elongate, subcylindrical; reddish brown; sides and base of prothorax and base and apex of elytra definitely sprinkled with yellow hair; scutellum completely clothed with yellow pile; three elytral bands formed of the same pile, the subbasal slightly behind basal

fourth, almost transverse, narrowed outwardly, and triangularly enlarged at suture, the second at middle, very oblique, broader and acutely angulate near suture, its sutural limb reaching backward to the suture, and the third near apex, oblique, broad and somewhat triangularly enlarged at suture, beneath with yellow patches on meso- and meta-epimeron and posterior margins of first and second abdominal segments. Head rather coarsely punctured and granulate; antennæ almost reaching middle of elytra, with segments 5-11 forming a narrow club. Prothorax longer than broad, slightly broader than elytra, narrowed at base and apex; sides scarcely arcuate; disk slightly longitudinally cristate at middle, with few transverse tubercles along crest and at sides, especially anteriorly and posteriorly. Elytra about two and one-half times as long as prothorax, with straight sides gradually narrowing; apices obliquely truncate within, the angles subacute. Apex of posterior femora acutely toothed; the posterior tibiæ long, curved, slightly dilated outwardly and grooved on inner and outer side. Length, 11 mm,; breadth, 2.5 mm.

Holotype (No. 2450, Mus. Calif. Acad. Sci.), a unique secured by Mr. E. P. Van Duzee at **Nogales, Arizona,** April 3, 1921.

This elegant species belongs in the group with *approximatus, abbreviatus, peninsularis,* and *tenuiscriptus,* from all of which it differs by having the subbasal and subapical yellow elytral bars triangularly dilated at the suture. In *Neoclytus approximatus* Lec. the anterior band is narrow and transverse; in *Neoclytus abbreviatus* Schffr. it runs obliquely upward and is broken; in *Neoclytus peninsularis* Schffr. the subbasal band is much as in *abbreviatus,* but the middle is not hooked; while in *Neoclytus tenuiscriptus* Fall the anterior band is quite oblique, the middle less oblique than in *vanduzeei* and the antennæ shorter and more suddenly clubbed.

Neoclytus modestus zebratus Van Dyke, new subspecies

As shown by Mr. Alonzo Davis,[5] *Neoclytus modestus* Fall and *Neoclytus carus* Fall are sexes of the same species, the first, the male, having priority. It seems to be confined to the mountains of southern California. In the mountains of northern California and southern Oregon the typical species is replaced by a phase where the males differ only by having no white patches on the meso-epimera and but a slight amount on the meta-epimera, and the females by having the ornamental bands of white pile, not yellow, the three fasciæ, especially the anterior,

5 Pan-Pacific Entom., Vol. I, No. 4 (April, 1925), p. 169.

somewhat narrower, and the meso-epimeron without a tuft of hair as in the males. This, I have named as a new subspecies.

Holotype, female, No. 2451, and allotype, male, No. 2452, Mus. Calif. Acad. Sci., and four paratypes, three males and one female, in the Van Dyke collection. These were beaten by me from a species of scrubby live oak, near **Meadow Valley, Plumas County, California,** June 10, 1924. I have also examined four other males in the collection of the California Academy of Sciences, taken at the following localities: Santa Clara County, California, July 22, 1914; Castle Crags, Shasta County, California, July 9, 1921; Cayton, Shasta County, California, July 9, 1913; and Colestin, Jackson County, Oregon, August 1, 1918. A phase from Keen Camp, Riverside County, California, collected by Mr. E. P. Van Duzee, June 6-12, 1917, should also be placed here though it differs slightly. It is a female which has the anterior band more transverse and broken and the posterior band more crescentic than is the case with the northern phases but with the markings white and otherwise the same.

This subspecies might at first sight be confused with some of the numerous phases of *Neoclytus muricatulus* (Kirby), a spruce and fir-feeding species. It has, however, the scutellum clothed with white hair, not naked and black as in *muricatulus,* and the inner oblique truncature of the elytral apices somewhat emarginate and spiniform at the margins. *Neoclytus infans* Casey is but a local form of *muricatulus.*

Neoclytus magnus Schffr. In the collection of Dr. F. E. Blaisdell are two specimens of this splendid species caught on the outskirts of San Diego, California, by the doctor's mother.

Swarming Termites

A CORRECTION

In an article with the above heading appearing in *The Pan-Pacific Entomologist,* III:92, 1926, the following statement was made: "No individuals were seen to be in copulation: this, according to Dr. S. F. Light, had already occurred, and the males were simply following the females in search of a suitable place for founding a new colony." This was an error in quoting Doctor Light: pairing had already occurred, but copulation does not take place until a suitable place to establish a colony is found. February 23, 1927.—E. O. Essig.

GENERIC NOTES (LEPIDOPTERA, PHALÆNIDÆ, CUCULLIINÆ)

BY WILLIAM BARNES AND F. H. BENJAMIN
Decatur, Illinois

Pseudanthœcia Sm.

Type *Lygranthœcia tumida* Grt.

1883, Smith, Trans. Am. Ent. Soc., X, 213, *tumida* sole species and therefore type.
1893, Smith, Bull. U. S. N. M., XLIV, 286.
1895, Grote, Abh. Nat. Ver. Bremen, XIV, 111, type designated *tumida.*
1903, Dyar, List, 191.
1903, Holland, Moth Book, 228.
1906, Hampson, Cat. Lep. Phal. B. M., VI, 114, type designated *tumida.*
1925, Draudt, in Seitz, Macrolep., VII, 178.

This is a peculiar Heliothid-like genus with a strong clypeal plate. Hampson's key states that the fore tibia is armed with a claw, but he does not mention this claw in his generic diagnosis. We are unable to find a claw in any of the specimens in a series of fourteen individuals.

The Mexican *Pseudanarta heterochroa* Dyar is a species closely allied to *tumida,* and probably falls into *Pseudanthœcia.* The eyes of the Mexican species are slightly wider than those of the North American species, but as all other characters agree, we do not erect a new genus for *heterochroa,* although it may deserve one.

Under the generic name *Bryomima* Staud., Hampson, 1906, Cat. Lep. Phal. B. M., VI, 386 et seq., and Draudt, in Seitz, 1926, Macrolep., VII, 202, have included a number of species from North America, many of which are not congeneric with one another and none of which seem congeneric with the Mesopotamian *Bryomima carducha* Staud.

Of these *pulverulenta* Sm., originally described as a *Perigea,* structurally appears to be the same as many of the species placed in *Pseudanarta.* Unfortunately, although the hind wings have a somewhat yellowish cast, they are not bright yellow as in other *Pseudanarta* species. Nevertheless, unspread specimens of *pulverulenta* present to a surprising degree the same habitus

as unspread *Pseudanarta* species. We suggest placement of *pulverulenta* in *Pseudanarta.*

"Bryomima" fallax Hamp. (*falsa* Grt., partim.), form *uintara* Sm., and *distans* B. and McD. form a group with the frons strongly rounded out, and with a habitus like certain species placed by various authors in *"Namangana." Bryomima muscosa* Hamp. presumably also belongs to this group, judging from Hampson's figure. It is unknown to us. We would think it likely the ordinary female of *fallax* were it not for the fact that Hampson lists a female under *fallax.* We have already discussed the synonymy of *fallax* versus *falsa,* 1926, Pan.-Pac. Ent., II, 108.

For the *fallax* group we erect the genus

Pseudobryomima gen. nov.

Type *Bryomima distans* B. and McD.

Proboscis fully developed; palpi obliquely upturned to above middle of frons, the second joint fringed with hair in front, the third short; frons strongly rounded out and slightly roughened; eyes large, rounded, ciliated; antennæ of male beaded and ciliated; thorax roughly clothed with serrated spatulate scales mixed with some hair, prothorax with a spreading crest, metathorax with a large spreading crest; tibiæ fringed with hair; abdomen with dorsal crest at base only. Fore wing with the termen obliquely curved, veins 3, 5 from near angle of cell; 6 from upper angle, 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hind wing with veins 3, 4 from angle of cell; 5 obsolescent from somewhat below middle of discocellulars; 6, 7 short stalked from upper angle; 8 anastomosing with cell near base only.

Hampson and Draudt also place in *Bryomima "Hadena" chryselectra* Grt., "subspecies 1" of Hampson having been given the name *orizabæ* by Strand. Professor Draudt kindly supplied us with a pair of the Mexican *orizabæ,* which appears to be congeneric with *chryselectra,* but seems to represent a distinct species. We have not seen it from the United States.

For the *chryselectra* group we erect the genus

Hemibryomima gen. nov.

Type *Hadena chryselectra* Grt.

Proboscis fully developed; palpi obliquely upturned to above middle of frons, the second joint fringed with hair, the third short; frons smooth; eyes large, rounded, ciliated; antennæ of male serrate and

fasciculate; thorax clothed with scales mixed with hair and hair-like scales, the prothorax with a slight spreading crest, the metathorax with a large spreading crest; tibiæ fringed with hair on outer side; abdomen with a rough vestiture of scales mixed with hair, a small dorsal crest at base only. Fore wing with the termen obliquely curved; veins 3, 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hind wing with veins 3, 4 from angle of cell; 5 obsolescent from somewhat below middle of discocellulars; 6, 7 from upper angle; 8 anastomosing with cell near base only.

"Perigea" loculosa Grt. is a species which has been referred to *Perigea,* by Grote, Smith, and Dyar; to *Homohadena,* by Hampson, Barnes and McDunnough, Barnes and Benjamin, and Draudt; and to *Bryomima* by Dyar. We have published upon the specific synonymy, 1925, Proc. Ent. Soc. Wash., XXVII, 126. The species possesses thoracic and abdominal tuftings similar to *Bryomima* Auct. nec. Staudinger; but the vestiture consists of few broad scales, being mainly hair and narrow bifurcate hair-like scales. The habitus is decidedly that of a member of the Apatelinæ, being remarkably similar to that group of *"Namangana"* of authors (*Draudtia* B. and Benj.) containing *continens* Hy. Edw., *costa* B. and Benj., *tapeta* Sm., and *seitzi* B. and Benj. In other words, resemblance to *Perigea* or *Hadena* in the sense of Smith, is worthy of note, especially as the male genitalia possess a battledore shaped harpe. This shaped harpe is a marked deviation from the more pointed types normal to the Cucullinæ, suggestive of some sort of connection with either the Apatelinæ or the Hadeninæ. But because of the lashed eyes *loculosa* would certainly fall into the Cucullinæ as this is now defined. We are not attempting to substantiate lashed eyes as being of real subfamily significance, for we realize that the character appears to fail in a number of instances. Nevertheless, until some other characters are found, we prefer to retain *loculosa* in the Cucullinæ.

For *"Perigea" loculosa* Grt., or *Homohadena loculosa* of authors (= *Bryomima continentis* Dyar; = *Bryomima oziphona* Dyar), we propose the generic name

Properigea gen. nov.

Type *Perigea loculosa* Grt.

Proboscis fully developed; palpi obliquely upturned, the second

joint not reaching middle of frons, the third short; frons smooth; eyes large, rounded, ciliated; antennæ of male with the joints slightly marked but not serrate, ciliated; thorax clothed mainly with narrow bifurcate hair-like scales mixed with some hair and a few broader scales, the prothorax with a slight spreading crest, the metathorax with a crest; tibiæ fringed with hair on outer side; abdomen clothed with scales and hair, with a dorsal tuft at base only. Fore wing rather narrow, the termen obliquely curved; veins 3, 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hind wing with veins 3, 4 from angle of cell; 5 obsolescent from somewhat below middle of discocellulars; 6, 7 variable, usually connate from upper angle, sometimes shortly stalked; 8 anastomosing with cell near base only.

A NEW GEOMETER FROM SAN DIEGO COUNTY

BY WILLIAM S. WRIGHT
San Diego, California

Dysstroma citrata hewlettaria Wright, *forma nova*

In 1914 the writer obtained a number of specimens of this new form taken at Nellie Post Office in the Pala district, Palomar Mountain, San Diego County, California, by Miss Esther P. Hewlett. Being unable to match them either with specimens in my collection or with available descriptions, I concluded that the series represented a new species and it was so diagnosed. Correspondence with Mr. Louis W. Swett seemed to point to possible error, so the diagnosis remained in manuscript. However, some specimens bearing the new name label were inadvertently distributed and two of them, now designated as Paratypes "y" and "z" fell into the hands of Dr. William Barnes. Recently Mr. Foster H. Benjamin called the matter to my attention while trying to check up on publication. As a result of correspondence with Mr. Benjamin it has been decided to publish the new name as a minor form of *citrata* Linn., lying between this species and its form *immanata* Haw. In the keys it will run to *citrata* Linn., but is uniformly lighter in color. It is much darker than *immanata* Haw. There is a decided tendency for all transverse lines to become obsolete and for diffusion of the bands. The outer edge of the subapical patch on the primaries is much more oblique than in the two forms mentioned and there is a rather even distribution of rufus

scales over the entire expanse. In size it runs smaller than either *citrata* Linn or *immanata* Haw.

Holotype, male, **Nellie Post Office,** Palomar Mountain, San Diego County, **California,** September 18, 1914, and allotype, female, Pala, San Diego County, California, October 11, 1914, in collection of Natural History Museum, San Diego, California.

Paratypes, 6 males, 6 females. September 1 to 19, in collection of Barnes, Decatur, Illinois. All but two of these are labeled "Nellie, San Bern. Co., Calif." which I believe to be in error, as there is no such locality shown on maps of San Bernardino County. Five males, 9 females. Pala, San Diego County, California. September 1 to 19, 1914, except two specimens dated 5-12-14 and 5-14-14 respectively. Collection of Natural History Museum and collection of George H. Field, San Diego, California.

I am indebted to Mr. Foster H. Benjamin, curator of the Barnes collection for the loan of comparative material and advice. The form is dedicated to Miss Esther P. Hewlett, who collected all the material under discussion.

A WASHINGTON RECORD FOR CICINDELA WESTBOURNEI WALLIS

BY W. KNAUS
McPherson, Kansas

I recently received from Mr. M. C. Lane of Toppenish, Washington, four specimens of a Cicindela labelled *C. senilis* var. At first glance they looked very much like *Cicindela fulgida* var. *parowana* Wickh. On comparison with my series of twelve specimens of this variety from Utah I found they were slightly different but were almost identical with the slight variation of *parowana* described by J. B. Wallis as *westbournei.* The only difference that could be noted between the Washington specimens, three from Ritzville and one from Lind, Adams County, and the *westbournei* specimens from Westbourne, Manitoba, Canada, was that the middle band of the elytra on the Washington specimens did not tend to expand along the margin.

The range of this variety must thus be extended many hundreds of miles southwest of Manitoba to southeast Washington, between the Rocky Mountains and Coast Ranges.

THE ABDOMINAL STRUCTURES OF THE ORTHOPTEROID FAMILY GRYLLOBLATTIDÆ AND THE RELATIONSHIPS OF THE GROUP

BY G. C. CRAMPTON, PH. D.
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Mr. Eric Hearle and Prof. Owen Bryant have generously supplied me with a fine series of Grylloblattid material, including practically all of the developmental stages of *Grylloblatta campodciformis* Walk., and, through the kindness of Mr. H. S. Barber, I have been able to obtain from a Californian collector a full-grown female nymph of *Grylloblatta barberi* Caudell. During a visit to the National Museum I had an opportunity of making sketches of an immature male of *Grylloblatta barberi* and a male of *Galloisiana* (Galloisia) *nipponensis* Cdll., through the kindness of Mr. A. N. Caudell, to whom I am likewise indebted for many favors in the past. To all of these gentlemen I would express my deep appreciation of their kindness, which has made this investigation possible.

The Grylloblattids are of such great interest and importance for the study of the Orthopteroid insects in general, that all of the features of Grylloblattid anatomy should be made available to entomologists who have an interest in the evolution and natural grouping of the insects with which they have to deal. There are no figures of the details of the entire abdomen of a Grylloblattid, however, and the terminal abdominal structures of the two sexes of *Grylloblatta barberi* have never been figured, so that the present paper is offered with a view to supplying some of this needed data; and the evidence of relationships furnished by the other parts of the body is also briefly reviewed in this paper.

According to Caudell, 1924, the differences between the Grylloblattid genera *Galloisiana* and *Grylloblatta* include the following features: (1) The presence of the posterior process (labeled *poc* in Fig. 2) in the male of *Galloisiana,* a process which is lacking in all of the recorded species of *Grylloblatta.* (2) The occurrence of stouter spines in *Galloisiana,* and slenderer ones in *Grylloblatta.* (3) The absence of a chitinous process on the dextral coxite of males of *Galloisiana,* and its presence in adult males of *Grylloblatta.* (4) The occurrence of nine segments in

the cerci of *Galloisiana,* as against eight in the cerci of *Grylloblatta.* (5) The occurrence of forty segments in the antennæ of *Galloisiana,* as against about thirty (as a maximum) in *Grylloblatta.* (6) The presence of large flange-like tarsal pads in *Galloisiana.* Mr. Caudell is apparently quite justified in erecting a new genus (*Galloisia,* which was later changed to *Galloisiana* because *Galloisia* was preoccupied) for the Japanese species because of these differences, but I think that he is wrong in maintaining that there are no tarsal pads at all in *Grylloblatta,* because in my material of this genus preserved in alcohol there are distinct tarsal pads like those labeled *tp* in Fig. 3.

Caudell, 1924, considers that the immature specimens of *Grylloblata* recently captured in California by Mr. H. S. Barber belong to a distinct species which Caudell has called *Grylloblatta barberi.* Mr. Caudell is apparently fully justified in considering the Californian forms as the representatives of a new species (despite the fact that only their immature stages are known) since, among other differences, the sinistral coxite (*cxi* of Fig. 8) of an immature male of *Grylloblatta barberi* is much slenderer than the corresponding left coxite (*cxi* of Fig. 5) of an immature male of *Grylloblatta campodeiformis,* and the coxites differ markedly in shape in the two insects. Since the coxites do not change greatly as the male Grylloblattids become mature, these differences will doubtless hold good in the adult stages as well.

In comparing the terminal abdominal structures of an immature male of *Grylloblatta* (Fig. 5) with an immature female of the same species (Fig. 9) it is apparent that the coxite *cxi* of the ninth abdominal segment or uromere of the male (Fig. 5) corresponds to the elongated coxite, coxite *dv* of the ninth uromere of the immature female (Fig. 9), and the styli *st* of the male (Fig. 5) are likewise homologous with the styli *st* of the female (Fig. 9). There are no appendages of the eighth uromere or abdominal segment of the male corresponding to the appendages of the eighth uromere of the female.

Doctor Walker maintains that, with the exception of female Odonata, male Grylloblattids are the only Pterygotan insects which retain distinct, styli-bearing coxites in their adult stages, and I formerly held the same opinion. Recently, however, in studying the genitalia of insects related to the Hemiptera and

the members of the Holometabolous orders, I have found distinct styli-bearing coxites in the females of certain Lampyroid Coleoptera, in certain Hemiptera, etc., and such structures are apparently of wider occurrence than either of us realized and statements concerning their occurrence need revision. Since these styli-bearing structures occur in adults of the above-mentioned insects, it is not wholly improbable that the ancestors of the Grylloblattids exhibited distinct styli-bearing coxites in the adult stages of both sexes, while only the males of *Grylloblatta* exhibit them in the adult condition at the present time.

When the female nymphs of *Grylloblatta* become adult the following changes take place in the ovipositor and the region at its base: the stylus *st* (Fig. 9) of the nymph is lost, and the elongated coxite *dv* (Fig. 9) of the nymph becomes the dorsal valve *dv* of the adult (Fig. 10). The inner valve *iv* (Fig. 9) of the nymph becomes the inner valve *iv* (Fig. 10) of the adult, and the ventral valve *vv* (Fig. 9) of the nymph becomes the ventral valve *vv* (Fig. 10) of the adult. The small coxite *bv* (Fig. 9) of the eighth uromere (abdominal segment) of the nymph takes part in the formation of the basivalvula *bv* (Fig. 10) of the adult, and the region of the ninth sternite bearing the label *vf* in Fig. 9 of the nymph, becomes the valvifer *vf* of the adult insect shown in Fig. 10.

From the foregoing it is evident that it is a comparatively easy matter to compare the parts of an adult female with those of an immature female, and it is also comparatively easy to homologize the parts of both of these with the parts of the male insect. It is somewhat more difficult, however, to interpret the parts of the ovipositor in terms of the primitive biramous Crustaceoid limb (i. e. a limb composed of a basal portion or protopodite bearing an outer branch or exopodite, and an inner branch or endopodite) because the different investigators are not agreed as to whether the inner valves of the ovipositor belong to the ninth or to the tenth uromere (abdominal segment). Walker, however (whom I have followed in these matters), considers that the inner valves belong to the ninth uromere, and if this be correct the parts of the ovipositor of the female nymph may be interpreted in terms of a biramous appendage in the following fashion; the elongated coxite *dv* of Fig. 9 represents the protopodite of a biramous limb of the

ninth abdominal segment, in which the exopodite forms the stylus *st* and the endopodite forms the intermediate valve *iv*. The short coxite *bv* of Fig. 9 represents the protopodite of the limb of the eighth abdominal segment, which has lost its exopodite or stylus, but has retained its endopodite, represented by the ventral valve *vv* of Fig. 9. In the adult female (Fig. 10) the dorsal valve *dv* would then represent the elongated coxite or protopodite of a biramous limb of the ninth uromere, which loses its stylus or exopodite when the insect becomes mature, but this limb of the ninth uromere retains its endopodite to form the inner valve *vv* of the adult shown in Fig. 10. The sclerite *vf* of Fig. 10 is merely a portion of the sternum of the ninth uromere bearing the dorsal (*dv*) and inner valve (*iv*) of the ovipositor. The parts of the eighth segment have the following interpretation. The coxite or protopodite of the limb of the eighth uromere forms the sclerite *bv* of Fig. 10, and the endopodite of the limb of the eighth uromere is retained to form the ventral valve *vv* of the ovipositor of the insect shown in Fig. 10. The limb of the eighth uromere has no stylus (exopodite) so that this structure is not represented in the eighth uromere of the nymph or adult insect. In the male insect (Fig. 8) the coxite *cxi* represents the protopodite of the limb of the ninth uromere, and the stylus *st* represents its exopodite. The endopodite of the limb of the ninth uromere may be represented by the parameres, but this point has not been definitely determined.

The parapodial plates or paraprocts *pa* of Figs. 8, 9, 10, etc., apparently represent the coxites or modified protopodites of the limb of the eleventh (or tenth) abdominal segment, whose exopodite is lost and whose endopodite forms the cercus *ce*. At any rate, the cercus develops exactly like the thoracic limbs in the embryo according to Wheeler, Heymons and other embryologists, and since the limbs of the thorax are acknowledgedly endopodites, this would indicate that the cerci also represent endopodites rather than exopodites (see Crampton, 1921), and the condition exhibited by certain Crustacea also lends weight to this view, which is discussed more at length in the paper cited above.

Since *Grylloblatta* is such a primitive Orthopteran, I had hoped that it would throw some light on the question as to

whether the epiproct *ep* of Figs. 8 and 9 represents the tenth tergite, or the tenth tergite and eleventh tergite united to form an apparently single sclerite; but there is no indication of a transverse division of the epiproct in *Grylloblatta* despite the fact that certain other Orthoptera show some indications of such a division. Furthermore, none of the stages of *Grylloblatta* in my series shows any indication of the presence of a twelfth segment or telson, and I must confess that I am extremely skeptical as to the correctness of the claims of those who profess to be able to find traces of a twelfth "segment" or telson in the postembryonic stages of any Pterygotan insect (although twelve segments occur in the abdominal region of the Protura). The membranous rectal lining labeled *er* in Figs. 9 and 10, has become everted in some of the specimens thrown into alcohol while still alive, but this rectal lining can hardly be interpreted as the remains of a twelfth segment. The rectal lining is frequently everted in Psocids, Isoptera, and related forms, if the specimens were thrown into alcohol, and it would be of some interest to determine whether this eversion of the rectum is the result of the action of the preserving fluid, or whether (as is more probably the case) it is caused by the irritation set up by the alcohol, etc. There have been no experiments to determine whether the eversion of the rectal lining is in any way associated with repelling enemies, and it would be interesting to know if there are any repugnatorial glands in this region. The fact that this eversion of the rectal lining occurs in Isoptera, Grylloblattids, Gryllotalpids, Psocids, etc., has some significance in indicating a relationship between the insects in question, as will be discussed later.

Mr. Caudell apparently considers that none of the described species of *Grylloblatta* is adult; but Miss Ford has described the mating, egg-laying, etc., of *Grylloblatta campodeiformis*, and no one who has made a study of the genitalia of the males and the abdomen of gravid females of *Grylloblatta campodeiformis* can doubt the maturity of these forms.

The abdomen of a gravid female of *Grylloblatta campodeiformis* is shown in Fig. 10. The abdomen of the specimen there figured was abnormally distended due to the action of the fluid in which it was preserved; but the specimen in question is extremely well chitinized and pigmented, and the parts are

exceptionally favorable for study, and I have, therefore, made it the basis of the drawing shown in Fig. 10. The tergites and sternites are quite widely separated in the specimen in question, and the membranous regions of the abdomen are apparently capable of considerable distention. The third to the sixth tergites (inclusive) are the broadest, and the seventh sternite is the longest.

As is shown in Fig 4, the first sternite 1^s is separated from the posterior region *ss* of the metasternum by a membranous area, instead of being closely associated with the metasternum, as is the case in the first sternite of other Orthoptera. Beneath the first sternite is an eversible sac bearing the label *pr* in Figs. 1, 4 and 10, and this structure probably functions as a repugnatorial "gland." In the nymph of *Grylloblatta barberi* shown in Fig. 1, the everted sac is rather slender. In the adults of *Grylloblatta campodeiformis* shown in Figs. 4 and 10, the structure in question is somewhat larger, and the "gland" may be better developed in the adults than in the nymphal stages.

In some specimens of *Grylloblatta campodeiformis* there are slight indications of a deposition of chitin and pigment about the proximal spiracles; but for the most part the spiracles lie in the membrane near the margins of the tergites as shown in Fig. 10. The abdominal spiracles of the Grylloblattids are very small, and are rather difficult to detect.

The egg shown in Fig. 6 is about one and five-sevenths mm. long and five-sevenths mm. broad. It is black in color, is somewhat more rounded at the posterior(?) end, and is slightly more pointed at the anterior (?) end. The supposedly ventral side is directed toward the top of the page in Fig. 6, and is somewhat more convex than the opposite side of the egg. In the region *m*, which may represent the micropylar end, the tiny processes (which occur at the opposite end of the egg also) on the surface of the egg give a roughened appearance to this area. The eggs are laid singly, and are probably deposited in moss or similar substances during the nocturnal wanderings of the female.

The fact that Grylloblattids raise the abdomen high above their heads when irritated, indicates that they are "psychically" allied to the Dermaptera, but their egg-laying behavior is "out-and-out" Orthopteran. Their nocturnal habits, and their ten-

dency to hide under stones, logs, etc., are shared alike by the earwigs and certain Orthoptera.

In color the Grylloblattids are very suggestive of Phasmids such as *Timena,* or certain of the paler earwigs. They also approach certain termites in the color of the body in general, and I think that these features, as well as the structures of the body, etc., are of some value in indicating their relationships and evolution, as will be presently discussed.

Before taking up the discussion of the relationships indicated by the various anatomical structures of the Grylloblattids, I would call attention to the method of grouping the Orthopteroid insects (i. e., the Paurometabola or Orthopteradelphia) into superorders representing the natural relationships of the insects in question, as indicated by comparative anatomy, the palaeontological record, and other features. There are three principal superorders of Orthopteroid insects, as follows: (1) The *Panisoptera,* including the fossil Protoblattids, Blattids and Mantids, Isoptera, etc. (2) The *Panplecoptera,* including the fossil *Hadentomoidea,* Embiids, Plecoptera, etc. (3) The *Panorthoptera,* including the fossil Protorthoptera, Grylloblattids and Saltatoria, Phasmids, Dermaptera, etc. All of these insects were apparently descended from common ancestors in the common Protorthopteran-Protoblattid stem (see Textfigure A which gradually split into the Protoblattids (which retained most of the ancestral features of the group) and the Protorthoptera. Although all three superorders were derived from ancestors in the common Protorthopteran-Protoblattid stem, the ancestors of the Panorthoptera and Panplecoptera were probably somewhat more Protorthopteroid, while the ancestors of the Panisoptera were probably slightly more Protoblattoid, although all three groups naturally merge, as we trace them to their ultimate origin in the common Protorthopteran-Protoblattid stem.

The common ancestors of all of these forms in the common Protorthopteran-Protoblattid stem may have exhibited the following characteristics: They were possibly nocturnal or tended to hide under stones, logs, etc. The color was probably yellowish brown. Head prognathous and Plecopteroid or Dermapteroid (i. e., like that of an earwig, with eyes on side of head, antennæ borne below the eyes, near the base of the man-

dibles, etc.) and provided with three ocelli. Temporal sutures probably present, demarking the temporal regions from the parietals. The proximal segments of the antennæ were doubtless much shorter than the distal ones, which tended to become more elongated and cylindrical. The cervical sclerites were well developed in the lateral region of the neck, and in the prothorax the trochantin intervened between pleural region and the coxa. The pleural suture was continued downward into the trochantinal region, and the trochantin was divided into several areas by sutures, clefts, etc. The pronotum was demarked into a small anterior region and a larger posterior one by a transverse suture. The spinisternal region of the prothorax was closely associated with the spiracles. The meso- and metathorax were subequal, although the metathorax tended to surpass the mesothorax in size, and the hind wings tended to become larger than the fore wings, and doubtless bore an anal fan. A distinct laterosternite was present in both meso- and metathorax, and the coxæ were Blattoid. The tarsi were pentamerous, and tarsal pads or "soles" were probably present on all segments of the tarsi. The ovipositor of the female was probably rather short, but was not concealed by a hypogynium, or subgenital plate, and the valves of the ovipositor were subequal in length. In the immature females the dorsal valves bore styli, and it is barely possible that these were retained even in the adult stages. In the males separate and distinct styli-bearing coxites were borne in the posterior region of the hypandrium or ninth sternite, and the phallus or copulatory portion of the genitalia was probably composed of lobe-like structures provided with accessory chitinous outgrowths, etc. The paraprocts were well developed, and the epiproct may have been divided by a transverse suture or similar division line. The cerci were composed of a number of segments, and the distal ones tended to become more elongated and cylindrical. From ancestors in the common Protorthopteran-Protoblattid stem exhibiting characters like those described above were descended the Grylloblattids and their Orthopteroid relatives. The Grylloblattids have retained many of these ancestral features, and they combine in themselves certain characters found in other Orthopteroids, making the study of their anatomy of the greatest importance from the standpoint of phylogeny. The most important of these features,

and the relationships indicated by them, may be briefly indicated as follows:

(1) ANTENNÆ. As described by Crampton, 1917_a, the antennæ of *Grylloblatta* are strikingly similar to those of *Embia,* and resemble the antennæ of such primitive Phasmids as *Timema* very markedly. The Acridoidea (i. e., Acrididæ, Tettigidæ, Tridactylidæ, etc.), have antennæ resembling those of *Grylloblatta* more closely than is the case with the antennæ of the Grylloidea and Tettigonioidea. This probably indicates that the ancestors of the Acridoidea, Grylloblattids, Embiids, certain Phasmids, etc., had antennæ like those of *Grylloblatta,* although some of the ancestral Orthopteroid types undoubtedly had antennæ more like those of roaches, Mantids, crickets, Tettigoniids, etc.

(2) HEAD CAPSULE. The head capsule of *Grylloblatta* is markedly Dermapteroid, as was pointed out by Crampton, 1926_a. The head capsule of the Embiids, Phasmids, and Plecoptera are essentially of this type, and all of these have retained this primitive type of head capsule from their common ancestry. The head capsule of these forms is much more like that of *Lepisma* (and is therefore more primitive) than is the head capsule of the Blattids and Mantids.

(3) LABIUM. The underlip of *Grylloblatta* is Orthopteroid according to Crampton, 1926_a, and resembles the underlip of the Gryllids and Tettigoniids very closely. The evidence from this source would indicate that *Grylloblatta* is an Orthopteron, or a member of the superorder Panorthoptera, and probably inherited this type of labium from the common Protorthoptera-like forebears of the Panorthoptera.

(4) NECK AND PROTHORAX. The neck plates of *Grylloblatta* are Orthopteroid (see Crampton, 1926_b), and they are also very suggestive of the neck plates of the Isoptera in many respects. The pronotum, with its transverse suture, is very like that of certain Dermaptera, Embiids, etc., and the propleuron is strikingly similar to that of the Dermaptera and Embiids, but also shows Isopteroid affinities. These facts are in accord with the evidence from other sources indicating that the Isoptera are very like the Protoblattoid ancestors in the common

Protorthopteran-Protoblattid stem giving rise to the lines of descent of the Protorthoptera, Grylloblattids, Dermaptera, Embiids, etc., and the more immediate ancestors of the latter groups were probably Protorthopteroid in character.

(5) Mesothorax and Metathorax. The thoracic sclerites of *Grylloblatta* were discussed by Crampton, 1915, but the analysis of the relationships indicated by the thoracic structures is much better presented in later papers. *Grylloblatta* together with the Isoptera and Zorapterous Psocids are the only insects of which I have any knowledge, in which a separate and distinct laterosternite occurs in both meso- and metathorax. This would be in line with other evidence indicating that the Isoptera approach the Protorthopteroid ancestors of the Grylloblattids, and these Protorthopteroid ancestors of the Grylloblattids were identical with, or were very closely related to the Isoptera-like, Protorthopteroid ancestors of the Psocids. Although the fact is not noted in the earlier papers, it is quite apparent that the pleural region labeled *lp* in Fig. 10 is an Isopteroid feature representing the so-called lateropleurite of the meso- and metathorax of certain Isoptera; and the character of the trochantin *tn* of Fig. 10 is very Isopteroid (although it is also Blattoid and Mantoid as well). The evidence of the thoracic sclerites would indicate that the Isoptera approach the Protorthopteroid ancestors of the Grylloblattids, Dermaptera, Embiids, etc., more closely than the Blattids and Mantids do, and many features in the thorax indicate that the Dermaptera and Embiids were descended from a Protorthopteroid ancestry identical with that of the Grylloblattids, although the Embiids tend to accompany the Plecoptera more closely in their evolutionary tendencies, as the ancestors of both of these groups began to develop away from the ancestral Grylloblattids.

(6) Legs. As was pointed out by Crampton, 1915, the coxæ of *Grylloblatta* are of the type occurring in Blattids, Mantids, and wingless Isoptera. This Blattoid type of coxa is probably the ancestral one for the superorders Panorthoptera and Panplecoptera, and the Zorapterous Psocids were probably descended from forms having coxæ somewhat like those of *Grylloblatta*. The pentamerous tarsi of the Mantids are very like those of the ancestors of the Grylloblattids, and some Man-

tids have flange-like tarsal pads very suggestive of those occurring in *Galloisiana* and in certain Gryllacrids. I now consider that the trimerous tarsi of Embiids, Plecoptera, etc., are secondary (the tarsal pads of Embiids, for example, indicate that the tarsi were originally composed of more than three segments) and the pentamerous type represents the ancestral one for these insects also. *Grylloblatta* apparently inherited its tarsal "pentamerism" from its Protorthopteroid ancestors in the common Protorthopteran-Protoblattid stem, and the Phasmids did the same; but the other members of the superorders Panorthoptera and Panplecoptera tend to lose the ancestral "pentamerism." In lacking a developed arolium, *Grylloblatta* has retained a condition suggestive of affinities with the Isoptera and Dermaptera; but certain Gryllacrid Orthoptera have also not developed an arolium, and it is quite possible that the ancestral Orthopteroids may have been of two types, one developing an arolium, and the other lacking it. It is uncertain whether or no the common ancestors in the common Protorthopteran-Protoblattid stem had an arolium, although it is not impossible that some had an arolium and others did not, at a very early stage of Orthopteroid development.

(7) Abdomen. The abdominal sclerites of *Grylloblatta* are Orthopteroid and indicate that *Grylloblatta* is a true member of the superorder Panorthoptera. There is something very suggestive of Isopteran affinities in the character of the sclerites in general in the abdomen of *Grylloblatta,* but it is difficult to say what these Isopteran characters are in regions other than the terminal segments — which show more than a hint of Isopteran affinities. The general outlines of the tergites and sternites of *Grylloblatta,* and the character of the parapodial plates, supra-anal plate, etc., are quite Isopteroid; but the Mantids also resemble the Grylloblattids in these features, and the ovipositor of the Mantids is much more like that of *Grylloblatta* than is the case with the ovipositor of such primitive Isoptera as *Mastotermes,* for example. Thus, while the Isoptera have retained certain features which doubtless occurred in the ancestors of the Grylloblattids, the Mantids have retained more of the ancestral features in the abdominal region.

(8) Ovipositor. The ovipositor of Grylloblatta is entirely Orthopteroid, as was pointed out by Crampton, 1917_b. Walker,

1919, however, gives a much better description of the ovipositor of *Grylloblatta,* and compares its parts with those of other Orthopteroid insects, although he apparently uses the term "Orthopteroid" to include Odonata and other forms not related to the Orthoptera in the sense indicated by the use of the term Orthopteroid in this paper. Not only is the ovipositor of adult Grylloblattids clearly Orthopteroid, but the styli-bearing dorsal valves of nymphal Grylloblattids are paralleled by the the styli-bearing dorsal valves of the ovipositors of certain Orthoptera as well. The ovipositors of nymphal Grylloblattids, however, remind one somewhat of the ovipositors of nymphal Blattids, Mantids, and soldiers of the termite *Mastotermes,* and the ovipositor of adult Mantids is very like the ovipositor of an adult Grylloblattid. These members of the superorder Panisoptera have apparently retained the fundamental type of ovipositor occurring in the common ancestors of the Panisoptera, Panorthoptera and Panplecoptera in the common Protorthopteran-Protoblattid stem. The members of the superorder Panplecoptera, however, have lost the ovipositor, and they are consequently less like the common ancestral type in this respect.

(9) Male Genitalia. Walker, 1919 and 1922, gives a fine description of the genitalia of *Grylloblatta,* which he likens to the genitalia of the Blattids and Mantids. The genitalia of *Grylloblatta* are of a somewhat more primitive type than those of the Blattids and Mantids, and the Grylloblattids have apparently retained the genitalia in a condition approximating the ancestral type more closely than any other members of the Orthopteroid superorders, although the Grylloblattids have naturally developed certain specializations of their own, as would be expected. Although the genitalia of the Grylloblattids resemble those of the Blattids and Mantids quite closely, they are evidently very like the type at the basis of the Orthopteroid forms and resemble those of the Phasmids very closely. The genitalia of the Embiids and Plecoptera have apparently departed further from the ancestral type, and have developed along their own lines of specialization. The Phasmids are remarkably similar to the Grylloblattid type in their genetalic features, but the Dermaptera do not resemble the Grylloblattids in these features as much as one would expect from the marked resemblance between the Dermaptera and Grylloblattids in other

respects. The Isoptera have also developed along their own lines of specialization (the male genitalia are not developed in those which I have examined); and all of these facts probably indicate that the genitalia are not equally modified in all of the orders of insects, and while they may be of value for indicating affinities in some groups, they are of less value in others.

(10) CERCI, PARAPROCTS, etc. As was pointed out by Crampton, 1917_b, the cerci of *Grylloblatta* are Plecopteroid in many respects, and they also resemble the type of cerci occurring in the immature stages of such Dermaptera as *Discrytina*. The cerci of the primitive termite *Archotermopsis* are likewise extremely like those of the Grylloblattids, and the cerci of certain Blattids and Mantids are somewhat suggestive of the type occurring in *Grylloblatta*. This probably indicates that the cerci of the common ancestors of the Panorthoptera and Panplecoptera were Plecopteroid in certain respects, and the termites approach these common ancestors in this respect somewhat more closely than the Blattids and Mantids do. The epiproct and paraprocts bearing the labels *ep* and *pa* in Figs. 8, 9, 10, etc., of *Grylloblatta* are decidedly Orthopteran, and add their evidence to that of other features indicating that the Grylloblattids are Orthoptera, or should be grouped in the superorder Panorthoptera. The epiproct and paraprocts of the Grylloblattids are also very like those of the Isoptera, and resemble these structures in the Mantids as well. This is in line with the evidence from other sources indicating that the Grylloblattids are extremely closely allied to the Orthoptera, and that the Isoptera approach the ancestors of the Grylloblattids in many respects, as is also true of the Mantids, although the Mantids are in general somewhat less like these ancestors than the Isoptera are.

(11) COLOR. The color of the Grylloblattids is a yellowish brown (or brownish yellow) and is very suggestive of that of certain termites. The color of the Grylloblattids is also very like that of certain Phasmids related to *Timema*, and one species of *Timema* is extremely like *Grylloblatta* in its general appearance. The Dermaptera are usually darker in color than the Grylloblattids are, but some of the earwigs also resemble the Grylloblattids in this respect. A few roaches and Mantids and some Plecoptera are brownish yellow, and some Embiids

are also yellowish brown in color, but on the whole the termites are nearest the Grylloblattids in this feature. Certain Tettigoniids and some of the Gryllids are colored like *Grylloblatta,* and these facts seem to indicate that the common ancestors in the common Protorthopteran-Protoblattid stem may have been yellowish brown or brownish yellow in color.

(12) BEHAVIOR, etc. Certain Tettigoniids such as *Ceuthophilus* and many crickets hide under stones, logs, etc., and share with *Grylloblatta* its habits of concealment; and most Tettigoniids are nocturnal, as are the Œcanthids and other Orthopteran relatives of the nocturnal Grylloblattids. The Dermaptera are nocturnal or hide under stones, etc., and Embiids hide in their tunnels thus exhibiting a tendency in this direction, and even the Plecoptera exhibit a tendency to hide in crevices, etc. The Isoptera as a group live in protected situations, and of course the roaches are nocturnal and hide under stones, in crevices, etc. These facts may be interpreted as indicating that the common ancestors of all these insects (i. e. the common Protorthopteran-Protoblattid stem) were probably nocturnal or tended to hide under stones, logs, etc. The "embarrassment" reaction of nibbling the foot, cleaning the antennæ, polishing the head and similar elaborate actions of "unconcern" upon coming "face to face" with one of its own kind is exhibited by the Grylloblattids and related Tettigoniids such as *Decticus,* etc., and evidently indicates a similar "physico-chemical" makeup in the nervous system of these insects. The reactions of *Grylloblatta* to a light brought near them in captivity are suggestive of those of roaches under similar conditions and much of its behavior is suggestive of "psychic affinities" with the roaches. The habit of holding the abdomen high over the head when irritated is shared alike by Grylloblattids and Dermaptera, and is such a peculiar reaction that it undoubtedly indicates a rather close relationship between the Dermaptera and Grylloblattids. The egg-laying habits of *Grylloblatta* are clearly Orthopteran, and the eggs are extremely like those of the Orthoptera, so that taking it all in all the evidence thus far available would indicate that the closest affinities of the Grylloblattids are with the Orthoptera, while they are somewhat less closely allied to the Dermaptera and Phas-

mids and still less so to the Embiids and Plecoptera. The Isoptera are their closest allies among the Panisoptera, and the Blattids and Mantids are slightly further removed, the Mantids being somewhat nearer than the Blattids are to the Protoblattid-like forms giving rise to the Protorthopteroid ancestors of the Grylloblattids and other members of the superorder Panorthoptera.

The principal points brought out in the foregoing discussion may be briefly summarized, as follows: All of the Orthopteroid insects (*sensu lato*) were ultimately derived from ancestors in the common Protorthopteran-Protoblattid stem, and these common ancestors were probably dark-loving forms hiding under stones, logs, etc. They were yellow brown (or brownish yellow), slender-bodied forms (Plecopteroid or Dermapteroid) having Dermapteroid heads, Isopteroid thoraces and coxæ, pentamerous tarsi, and hind wings with an anal fan. The abdomen was probably Grylloblattoid, or somewhat Mantoid, with Plecopteroid cerci.

From ancestors exhibiting the characters mentioned above were derived the Orthopteroid superorders; and the ancestors of the Psocoids, Holometabola, etc., were also very like these forms. As shown in Textfigure A, the Synarmogoidea connect these ancestral forms with the Palæodictyoptera (which in turn were derived from *Lepisma*-like ancestors) and these ancestral forms give rise to three main evolutionary groups. The first to branch off were the Protoblattids and their allies the Blattids and Mantids (i. e. the order Dictyoptera) and the Isoptera. The immediate ancestors of this group were somewhat more Protoblattoid than Protorthopteroid; but the immediate ancestors of the next two groups were somewhat more Protorthopteroid than Protoblattoid, and from such forms there developed in one direction the Embiids, Plecoptera and Hadentomoidea, while in the other direction were evolved the lines of descent of the Orthoptera, Phasmids, Dermaptera, and Protorthoptera.

In Textfigure B, I have endeavored to show the relationships of the Grylloblattids to the principal families of the order Orthoptera, although all of the Orthopteran families are not given in the tree there represented. The trees represented in Textfigures A and B should indicate that the branches are given off in three planes, but not knowing how to show this in the

figure, I shall merely call attention to the fact that a figure drawn in one plane does not correctly indicate the interrelationships of the lines of descent so depicted. Furthermore the Grylloidea (i. e. Gryllids and Gryllotalpids) are not the lowest representatives of the Orthoptera, as the figure might be taken to indicate, but the lines of descent of these forms were represented in this way to avoid crossing or overlapping in the figure.

As is indicated in Textfigure B, the Grylloblattidæ occupy a position at the base of the lines of descent of the Grylloidea and Tettigonioidea (or Locustoidea as they were formerly called). The Grylloblattids have departed but little from the Protorthopteroid ancestors of the Orthoptera in general, and their nearest relatives are the Tettigonioidea, the lowest representatives of which are the Gryllacridæ. The Grylloidea are almost as closely related to the Grylloblattids as the Tettigonioidea are, but on the whole the Tettigonioidea are somewhat nearer to the Grylloblattids than the Grylloidea are.

The fossil Elcanidæ may be related to the Tridactylidæ, although they exhibit certain features suggestive of a closer relationship to the Tettigonioidea. The Tridactylidæ have retained some features suggestive of the Gryllidæ from their ancient common ancestry, but the closest affinities of the Tridactylidæ appear to be with the Acridoidea and they approach the Acridoid family Tettigidæ in certain respects. The antennæ, tarsi, wings, ovipositor, etc., of the Tridactylidæ are certainly not Grylloid in appearance, but are very suggestive of the Acridoids in these respects, and the Tridactylidæ apparently occupy a position near the base of the lines of descent of the Acridoid families, as is indicated in the figure. The Tettigidæ are rather primitive Acridoidea in some respects, and their line of descent approaches that of the Tridactylids, but the closest affinities of the Tettigids are with the Acridids (and Pneumonids). The fossil family Locustopsidæ is rather like the ancestors of the Acrididæ, but we do not know enough about the ancestors of the Acridoidea (or Locustoidea as they are sometimes called) to do more than indicate their lines of descent in a general way, as shown in the diagram. The Grylloblattids have retained some ancestral features suggestive of those occurring in the primitive Acidoidea, but the closest affinities of the Grylloblattids are with the Tettigonioids and Grylloids, as was mentioned

above. In some respects the Grylloblattidæ are like living Protorthoptera, but they have also retained some features suggestive of an ancestry in forms more primitive than the Protorthoptera themselves, so that their line of descent is represented in Textfigure B, as though it sprang from the common Protorthopteran-Protoblattid stem from which the Protorthoptera also arose. The Grylloblattids, however, are probably true Orthoptera, although I formerly considered that they might represent a distinct order, the Archorthoptera or Notoptera. The principal superfamilies of the order Orthoptera, with their principal families would be grouped, as follows: (1) the Grylloblattoidea (with the single family Grylloblattidæ); (2) the Tettigonioidea (including the Gryllacrididæ, Stenopelmatidæ, Tettigoniidæ and Phasmodidæ, the latter are not to be confused with the Phasmidæ); (3) the Grylloidea (including the Gryllidæ and Gryllotalpidæ); (4) the Acridoidea (including the Tettigidæ, Pnueumonidæ, Acrididæ and Proscopidæ, to which the Locustopsidæ might be added, and the Tridactylidæ and possibly the Elcanidæ might likewise be grouped in this superfamily, although the Elcanidæ probably belong with the Tettigonioidea). The Grylloblattoidea, Tettigonioidea, and Grylloidea belong in the suborder Euorthoptera, while the Acridoidea constitute the suborder Metorthoptera quite sharply differentiated from the Euorthoptera.

The anatomical features of *Grylloblatta* were more or less correctly portrayed in my earlier papers dealing with the morphology of this insect, and the structures figured were correctly homologized for the most part; but in these earlier papers the interrelationships of the Orthopteroid orders were not always indicated correctly, as a wider knowledge of the forms in question has shown. I would therefore emphasize the fact that the views expressed in the present paper are more nearly in accord with the facts revealed by a further study of a wider range of structures in the more primitive representatives of the orders in question, which were not available to me before. In subsequent papers I am hoping to take up a more detailed study of the parts not already described in the Grylloblattids, giving particular attention to the evidence of relationships furnished by the various anatomical features of these extremely interesting and important insects.

References Cited

Caudell, A. N.

1924$_a$. A new Genus and Species of the Notopterous Family Grylloblattidæ from Japan. Proc. Ent. Soc., Washington, 26, p. 53.

1924$_b$. New Species *Grylloblatta barberi*. Jour. Washington Acad. Sci., 14, p. 369.

1924$_c$. Change of Galloisia to Galloisiana. Proc. Ent. Soc., Washington, 26, p. 92.

Crampton, G. C.

1915. Thoracic Sclerites and Affinities of Grylloblatta. Ent. News, 26, p. 337.

1917$_a$. Antennæ of Grylloblatta and Embiids. Can. Ent., 49, p. 213.

1917$_b$. Ovipositor of Grylloblatta and Related Insects. Jour. N. Y. Ent. Soc., 25, p. 225.

1917$_c$. Lateral Head, Neck and Prothorax of Grylloblatta and Related Insects. Ent. News, 28, p. 398.

1921. Terminal Structures of Insects and Crustacea. Ent. News, 32, p. 257.

1923. Maxillæ of Grylloblatta and Related Insects. Jour. N. Y. Ent. Soc., 31, p. 77.

1924. Phylogenetic Grouping of Insects. Jour. Ent. Zool., 16, p. 33.

1926$_a$. Head and Mouthparts of Grylloblatta. Psyche, 33, p. 78.

1926$_b$. Neck and Prothoracic Sclerites of Grylloblatta, etc. Trans. Amer. Ent. Soc., 61.

Ford, Norma.

1926. Behavior of Grylloblatta. Can Ent., 58, p. 66.

Walker, E. M.

1914. First Description of Grylloblatta. Can. Ent., 46, p. 93.

1910$_a$. Male and Immature Stages of Grylloblatta. Can. Ent., 51, p. 131.

1910$_b$. Ovipositor of Grylloblatta, etc. Annals Ent. Soc. America, 12, p. 267.

1922. Male Genitalia of Grylloblatta, etc. Ibid., 15, p. 1.

Abbreviations

bs.—Basisternum
bv.—Basivalvula (a modified coxite)
ce.—Cercus
cp.—Curvipleurite
cx.—Coxa
cxi.—Coxite
dv.—Dorsovalvula, or dorsal valve of ovipositor
em.—Epimeron
ep.—Epiproct, or supra-anal plate
es.—Episternum
er.—Endorectum, or endorectal lining
fs.—Furcasternum
iv.—Intervalvula, or intermediate valve of ovipositor
lo.—Phallic lobes
lp.—Lateropleurite
ls.—Laterosternite
m.—Supposed micropylar region of egg
pa.—Paraprocts, or parapodial plates
pc.—Pericercal pores
poc.—Postcornu, or posterior process
pr.—Primirepugnatorium or repugnatorium of first uromere
s.—Sternites
sp.—Spiracles
ss.—Spinasternum
st.—Stylus
t.—Tergites
tn.—Trochantin
tp.—Tarsal pads
vf.—Valvifer
vv.—Ventrovalvula, or ventral valve of ovipositor

The letter "t" written to the right and above the Arabic numerals indicates the tergite of the segment indicated by the numeral in question, while the letter "s" similarly placed, indicates the corresponding sternite.

Explanation of Figures

Fig. 1. Ventral view of first sternite, and its everted repugnatorial structure, of a female nymph of *Grylloblatta barberi.*

Fig. 2. Dorsal view of the terminal structures of a male of *Galloisiana nipponensis.*

Fig. 3. Ventral view of a portion of the terminal segments of the tarsus of *Grylloblatta campodeiformis.*

Fig. 4. Ventral view of posterior region of metasternum and first sternite of an adult female *G. campodeiformis.*

Fig. 5. Lateral view of terminal structures of an immature male of *G. campodeiformis.*

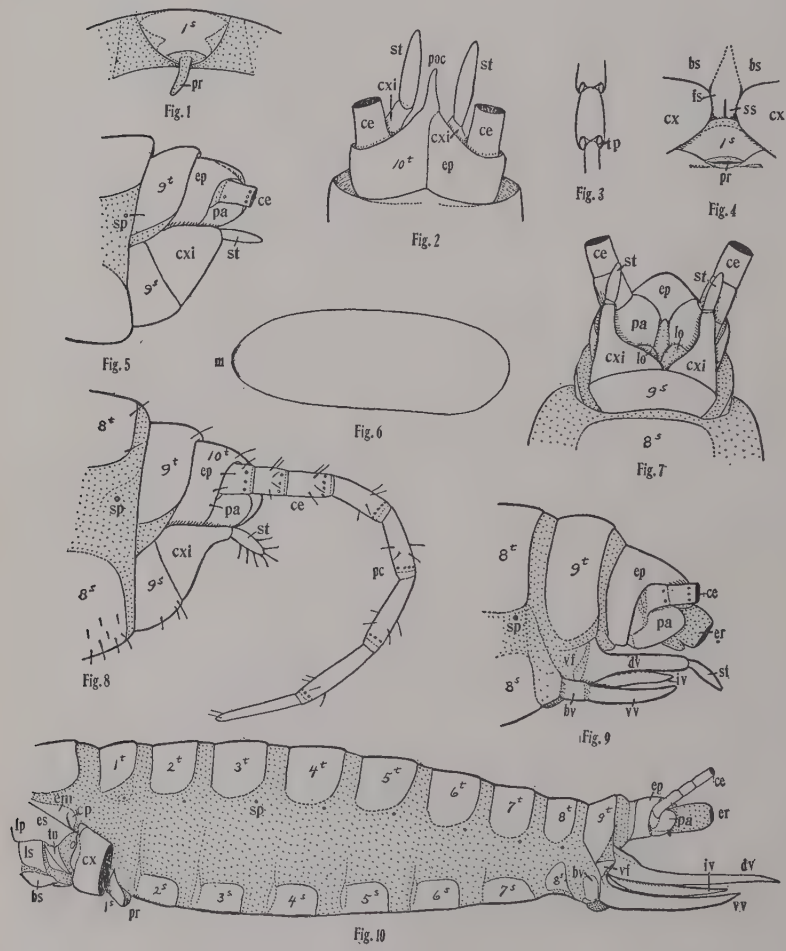
Fig. 6. Egg of *G. campodeiformis* viewed from right side with ventral side directed toward top of page.

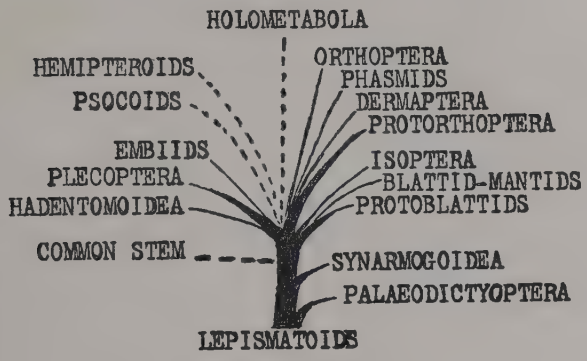
Fig. 7. Ventral view of terminal structures of an immature male of *G. barberi.*

Fig. 8. Lateral view of terminal structure of an immature male of *G. barberi.*

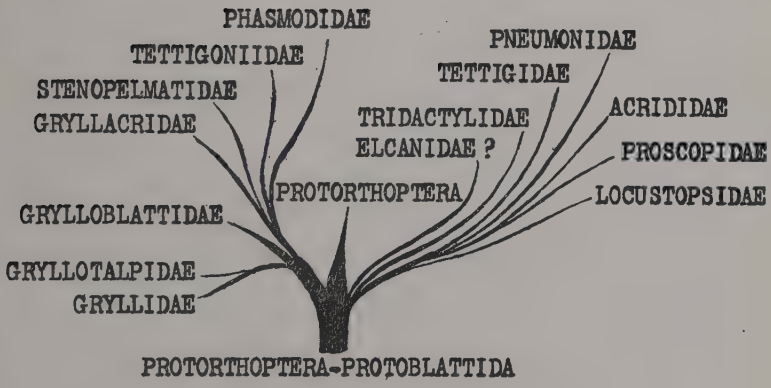
Fig. 9. Lateral view of terminal structures of nymphal female *G. campodeiformis.*

Fig. 10. Lateral view of abdomen of a gravid female of *Grylloblatta campodeiformis.*





Textfigure A



Textfigure B

A Chironomid Leaf-Miner

I have recently reared a Chironomid from serpentine mines in the leaves of semiaquatic species of Mimulus and Veronica, found at Berkeley, California, and an attempt is now being made to secure the details for a paper illustrating its life history. A careful search through the literature reveals no reference to a leaf-mining habit in the families of the Orthorrhapha. A recent letter to Dr. J. H. Comstock, which he referred to Johannsen, brought the statement that no Chironomid was known to be a leaf-miner although one was known to produce grooves in leaves.—Wyatt W. Jones.

CALIFORNIA MICROLEPIDOPTERA *

BY H. H. KEIFER
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GELECHIIDÆ

Recurvaria baccharíella Keifer, new species

The ground color of this species is cream white; this is overlaid with shades varying from fuscous to black, usually as a band across each scale just below the tip. To the unaided eye the fore wings are almost immaculate, especially the females. The apical fascia and scale tufts with black dots are the most conspicuous features under a glass. The holotype is as follows:

Palpi cream white, second joint somewhat rough and broadly expanding toward apex, truncate, suffused outwardly and below, except at base and faintly in middle with fuscous. Terminal joint short, arising from above center of truncate tip of second, blackish fuscous annulæ somewhat above base and barely below tip. Head light cream white, smoother on face but becoming rather rough above; face only slightly overlaid with fuscous except laterally; head above more evenly overlaid. Basal joint of antennæ heavily overlaid with dark fuscous, stalk annulate with fuscous. Thorax and fore wings cream white overlaid with fuscous, becoming black in some places on the wings. Fore wings with very indistinct markings but with five noticeable scale tufts. A tuft at basal fourth just below fold cream white, inwardly edged with blackish spot; a very faint outwardly oblique fascia, inwardly edged blackish, from costa, passing and disappearing just in front of tuft; at basal fourth just within costa a faint black spot. Just before middle of wing two opposite scale tufts; lower one on fold edged inwardly with blackish spot; upper one slightly above center of disk, edged costally with blackish, followed by a faint blackish spot; above these and slightly toward base on costa a faint blackish spot. At apical third two more opposite scale tufts, edged inwardly with blackish and connected by a cream white fascia; faint blackish spots costally and apically located from these tufts. From center of wing almost directly below origin of costal cilia a cream white inwardly oblique fascia to tornus. A small black spot on apex preceded by one on costa and two evenly spaced spots on termen. Just beyond these terminal spots a blackish fuscous line on basal part of cilia. Dorsal cilia very light fuscous on ground color. Hind wings light fuscous, cilia as in fore wings but with an ochreous tinge. Legs cream white overlaid with dark fuscous; hind tibiæ with a fuscous line on outer side from base to middle spurs, rest overlaid with fuscous. Tarsal joints on all legs cream white on tips and inwardly. Alar expanse: male, 13½; female, 12½ mm.

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* Contribution from the California Academy of Science, No. 382.

Holotype, male No. 2454, and allotype, female, No. 2455, Mus. Calif. Acad. Sci., reared from larvæ on *Baccharis pilularis* in **San Francisco, California,** by the writer, August 25 and September 14, 1926, respectively. Five paratypes, males and females, from same locality, dating from August 10 to September 20, 1926. The larvæ feed in the terminals destroying the bud and boring a short distance into the stem. They live concealed in a short silken gallery often covered with dead leaves.

Agnippe crinella Keifer, new species

This species, of which the following description is based on four males, is quite close to Busck's *A. evippella* according to that description, but has differences on the palpi, antennæ and fore wings, and is slightly larger.

Labial palpi white; second joint lightly dusted with blackish fuscous on inner side, heavily overlaid outwardly; terminal joint with black annulus just above base, tip black. Antennæ with basal joint white below, fuscous above; stalk fuscous, alternating darker and lighter annulæ. Head shining white; sides of face and vertex mottled with black. Thorax whitish, heavily overlaid with dark fuscous; tegulæ same, with ochreous tinged tips. Fore wings whitish overlaid with dark fuscous; basal two-thirds darker on costal side of fold (blackish), lighter dorsally, merging into apical third, which is evenly dusted, intermediate. Costal and dorsal areas separated by a narrow wavy white line generally on or near fold. Darker costal area produced across fold onto dorsum in a blunt lobe near base and a second, larger, just before middle. Between these lobes the separation line is ochreous tinged. This line ends in an ocellate-like spot (distinct in one), blackish center, on apical part of discal cell. Cilia from tornus and dorsum white. Hind wings light grayish fuscous, ochreous at apex; cilia whitish fuscous. Abdomen whitish, overlaid with fuscous except anal tuft. Legs white, barred and mottled with fuscous; on middle and hind tarsi with black. Expanse, 9 to 9½ mm.

Holotype, male, No. 2456, Mus. Calif. Acad. Sci., taken at Oroville, California, by the writer, July 15, 1926. Three male paratypes with the same data, also in the collection. These males have a long hair pencil on the base of the hind wing costa.

GELECHIA PANELLA Busck

This species is found occasionally at Mill Valley, Marin County, California. It has been taken there in February, March, April, August, September, October. There is also a specimen from Placer County and another from Los Angeles in the

collection. The determination is through the kindness of Miss Braun.

Gelechia occidentella Chambers

A very common Gelechiid in Marin County, especially in the late autumn. Indications seem to show that the winter is passed in the adult stage. Specimens in this collection range from San Mateo County to Inverness, Marin County, California.

A large series of this species has been reared from live oak, *Quercus agrifolia,* by myself, the larvæ collected in San Francisco. These larvæ were found from late June to late August. They live in a slight silken web among the leaves in the rearing jars and skeletonize the leaves. Pupation takes place in a very loose cocoon, which is likely spun in crevices of the bark or in trash. Adults emerged from September 7 to 27, 1926. The determination is by Miss Braun.

Gnorimoschema chenopodiella Busck

Chenopodium murale is heavily infested with this species in the Park in San Francisco. The larvæ live concealed in folded leaves and in the inflorescences. Miss Braun notes that these adults possess more black on the apical part of the wing than do eastern specimens.

Micropterygidæ

Mnemonica cyanosparsella (Williams)

Eriocrania cyanosparsella (Williams), Ent. News, XIX, p. 14, 1908.

On March 31 and April 1, 1926, a heavy infestation of a leaf-miner was noticed on live oak, *Q. agrifolia,* in Golden Gate Park, San Francisco. These miners were in the new spring leaves, which were nearly full size. The entire substance between the upper and lower epidermis was eaten away often involving the whole leaf.

In these mines were peculiar larvæ, somewhat elongate, stiffly bending themselves from side to side when disturbed. They soon went into the sand and formed small white cocoons.

A number of adults, emerging from December 6, 1926, to January 10, 1927, prove this species to be *Mnemonica cyanosparsella.* The tree was heavily infested, undoubtedly an important factor in stunting it, as a large proportion of the leaves were attacked.

NOTES ON WESTERN ARADIDÆ *

By E. P. VAN DUZEE
San Francisco, California

In 1921 appeared Doctor Parshley's Essay on the American Species of Aradus in which was recorded what was then known of our western species of the Aradinæ. Of the subfamily Mezirinæ there has been no recent revision of our American forms. The present paper records certain material accumulated in the collection of the California Academy of Sciences since 1921 in the Aradinæ, with somewhat fuller notes on our western Mezirinæ.

1. **Aradus vandykei** Van Duzee, n. sp.

Allied to *apicalis* and will run to that species in Parshley's key if the sides of the pronotum are considered to be granulated; as a matter of fact they are minutely crenulated as they are also in *apicalis,* from which species the present differs in the flat pronotum, less elevated scutellar margins and short genital segment of the female. Length, 7 mm.

Female. Vertex wanting the preocular tubercle, otherwise as in *apicalis.* Antennæ beyond base of segment II obviously thicker than in *apicalis,* with segment II longer. Rostrum shorter than in *apicalis,* not quite attaining hind margin of prosternum; bucculæ less elevated, its edge scarcely arcuated, in *apicalis* strongly lobed anteriorly. Pronotum shorter, three-fourths the length of the head, transverse, widest at basal third, anterior and posterior margins feebly excavated; surface nearly flat, transverse impressions feeble, sides scarcely elevated; edges irregularly granulate or minutely crenate, subparallel on basal third, thence rectilinear to anterior angles; carinæ distinct and straight. Scutellum a fourth shorter than in *apicalis,* nearly flat, subbasal ridge little elevated, sides narrowly recurved nearly to apex. Elytra as in *apicalis,* the membrane a little shorter with more slender veins. Apical lobes of abdomen longer than in *apicalis,* about twice as long at the rounded inner angles as at outer angles. Apical ventral segment slightly surpassing apex of seventh tergal segment.

Color blackish fuscous; antennæ black, segment I brown; sides of pronotum scarcely paler, tip of scutellum and legs testaceous yellow, apex of femora embrowned; elytra yellowish becoming blackish at apex and on basal and scutellar margins, with a few fuscous marks on the disk which omit the expanded humeri; abdomen paler tinged with red, with fuscous granules; rostrum brown.

Holotype, female, No. 2457, Mus. Calif. Acad. Sci., a unique,

* Contribution from the California Academy of Science, No. 383.

taken by Dr. E. C. Van Dyke, June 21, 1925, on **Mount Hood, Oregon.** Here the pronotum has the flattened form we find in *behrensi,* but it is wider posteriorly; it is shaped not at all as in *duzeei.* This species has three smooth areas on hind margin of pronotum, but they are not conspicuously polished, otherwise it would run to *ornatus* in Parshley's key; the form of the pronotum will, however, at once distinguish it from that species.

2. Aradus taylori Van Duzee

Proc. Calif. Acad. Sci., Ser. 4, IX, p. 335, 1920.

Mount Hood, Oregon, about 4000 feet, June 23, 1925, one male taken by Doctor Van Dyke and by him kindly presented to the Academy. This specimen differs in no way from the type taken on Vancouver Island.

Doctor Parshley sinks this species as a straight synonym of *proboscideus* Walker, but, assuming *hubbardi* to represent the true *proboscideus, taylori* should undoubtedly be retained as a good species. In *taylori* the antennæ are distinctly thicker, the preocular tubercle is reduced to a mere granule little larger than those of the adjoining surface, the postocular tubercle is smaller and obtuse, the pronotum is widest behind the middle, not broadly rounded as in *hubbardi,* the surface is much flatter with the carinæ less prominent; the scutellum is broader and flatter with the edges and base scarcely elevated, the former not at all sinuate but very feebly arcuate, becoming almost rectilinear toward the broader, rounded apex; the elytra are wider, with their base less expanded and the rostrum is shorter, not passing the base of the prosternum. The colors in *taylori* are less contrasting and the tip of the scutellum is concolorous. This comparison has been made between the male holotype of *taylori* and a male determined as *hubbardi* by Doctor Parshley, the latter altogether conspecific with a long series in the collection of the California Academy of Sciences. *Taylori* is a readily recognizable species and should be considered as distinct.

3. **Aradus patibulus** Van Duzee, n. sp.

Recalling *curticollis* Bergr. but showing many points of difference. Dark brown, the abdomen uniformly paler, almost reddish brown, third antennal segment honey-yellow. Length, 8 mm.

Female. Head as long as wide across the eyes; tylus short and thick; antenniferous tubercles short, nearly attaining middle of seg-

ment I, with a distinct lateral tooth; impressions on vertex broad and deep; preocular and postocular tubercles prominent but obtuse. Antennæ but little shorter than head and pronotum together, stout, segment I reaching beyond middle of tylus, a little thinner than anterior femora; II as thick as I, nearly as long as width of vertex between the eyes; III about two-thirds as long as II, toward base distinctly thinner than apex of II; IV two-thirds of III and nearly as wide. Eyes substylate. Pronotum shaped about as in *curticollis*; sides basally reflexed, edge coarsely granulate, becoming finely crenate anteriorly; surface flat, anterior field little elevated; granules confined to lateral areas; median four carinæ prominent, lateral subobsolete. Scutellum longer than pronotum, strongly narrowed apically, sides much reflexed. Elytra much narrower than abdomen; base strongly expanded and reflexed; mesocorium with one strong transverse vein, endo- and exocorium without veins; membrane uniformly wrinkled, with four strong veins. Abdomen suborbicular in outline, edge even, hind margins of segments slenderly calloused. Genital lobes less than half as long as wide, regularly arcuate. Rostrum attaining middle of anterior coxæ. Tibiæ with a vague broad darker median annulus.

Holotype, female, No. 2458, Mus. Calif. Acad. Sci., collected by Mr. J. O. Martin July 10, 1922, at **Martin's Springs, Lassen County, California,** at 6000 feet elevation. The broadly oval form with the pale yellowish third antennal segment will readily distinguish this interesting species. As in the case of *vandykei,* the type is unfortunately unique.

Mezirinæ

4. Mezira mœsta Stål

The examination of a long series of specimens placed under this name in the collection of the Academy of Sciences discloses two quite distinct species, which, however, have the same size, color and general aspect. In one, evidently the true *mœsta* Stål, the apical process of the head just passes the middle of the first antennal segment; segments II and IV are subequal and about one-third shorter than I, while III is but little longer than I and cylindrical. Head, pronotum, scutellum and middle area of sixth tergite coarsely granulate; broad expanded margins of the tergum coarsely rugose-punctate; genital plates of female prominent, rounded, almost attaining apex of genital valves, the latter produced in a blunt angle beyond the oviduct. In the male the genital segment is prominent, almost bulbous, with the lateral lobes small and ligulate. Venter closely rugose with a row of rounded smooth spots, two on a segment, at the stig-

mata, a similar geminate row within this and three single rows on the disk, the spots of the median row elongated.

This species is found from Monroe, Washington, to the Mexican boundary, especially along the foothills of the Sierra and Coast Range, attaining an elevation of 6000 feet in places. It seems to be the only species found along the coastal belt.

5. **Mezira reducta** Van Duzee, n. sp.

Like *mæsta* in all superficial characters. Antennæ rather shorter and stouter; segment I thicker, scarcely surpassing the rather deeply cleft frontal prominence, III as long as I and II together, IV obviously longer than I; postocular tubercles thick, subacute; membrane black, more closely reticulated and wanting the pale basal spot usually found in *mæsta*; sides of tergum more minutely rugose-punctate than in *mæsta*. Genital plates of female shorter, semicircular in outline; genital valves scarcely exceeding the oviduct, about equaling the plates; male genital segment broader. Other characters essentially as in *mæsta*. Length, 7.5 to 8 mm.

Holotype, male, No. 2459, and allotype, female, No. 2460, Mus. Calif. Acad. Sci., collected by Mr. J. O. Martin, May 19, 1922, at **Facht, Lassen County, California.** Paratypes same data and Stevenson's Creek, Fresno County, California, August 24, 1916 (F. E. Blaisdell); Carrville, Trinity County, California, June 19, 1913 (E. C. Van Dyke); Plumas County, California, November 16, 1917 (E. R. Leach). Described from a series of forty specimens. This species seems to be close to *rugicollis* Champion, but I cannot believe it the same. It seems to be more northern in its distribution. The shorter, thicker first antennal segment and shorter, rounded female genital lobes will readily distinguish it from *mæsta*.

6. Mezira granulata Say

Mount Lemon, Santa Catalina Mountains, Arizona, 7000 feet, July 26, 1924, under bark of pine logs. The short broad scutellum will distinguish this form from *mæsta* and its allies.

7. Mezira emarginata Say

A long series of this species was taken by Mr. J. A. Kusche at Needles, California, November 27 to December 4, 1921.

8. Neuroctenus simplex Uhler

Mr. C. D. Duncan has taken this species under bark of oak at Alford, Wise County, Texas, August 18, 1921.

UNDESCRIBED SPECIES OF TIPULIDÆ FROM UTAH (DIPTERA)

BY CHARLES P. ALEXANDER
Amherst, Massachusetts

The following undescribed species of crane-flies were included in a small series of specimens collected in Utah by Dr. James G. Needham and kindly sent to me for identification. The names are published in this preliminary paper in order to make them available for Doctor Needham's forthcoming report on the food of certain fishes. The types of the novelties have been deposited in the Cornell University collection. I wish to express my deep thanks to Doctor Needham for this kindly interest and for very many favors in the past.

Limnophila nemoptera Alexander, new species

Female. Length, 6.5 mm.; wing, 2.9 mm.

Described from an alcoholic specimen.

Rostrum very short, pale; palpi brown, all segments very short. Antennæ with but fifteen segments, the last two more or less fused; flagellar segments oval, gradually decreasing in size outwardly; basal segment of scape pale, the remainder of the organ dark brown. Head brown, paling into brownish yellow on the genæ.

Thorax yellow, the anterior median portion of the præscutum a little darkened. Halteres pale. Legs relatively long and slender; coxæ pale, the middle and hind coxæ elongated; trochanters obscure yellow; femora, tibiæ and basitarsi pale, the tips a little infuscated; terminal tarsal segments uniformly blackened. Wings reduced to long, narrow strips, pale yellow, with only the distal sixth or less weakly infuscated; wings longer than the combined head and thorax and about three times as long as the halteres alone; venation entirely degenerate.

Abdominal tergites brownish yellow with a dorso-median brown longitudinal stripe on the fourth to seventh tergites, including the caudal margins of the segments; basal sternites yellow, the outer ones a little darker with infuscated caudal margins; genital segment yellow. Ovipositor with the tergal valves rather angularly upturned opposite the level of the tips of the sternal valves.

Holotype, ♀, **Peterson's Spring, Utah,** one of the sources of the Logan River, altitude about 7500 feet, July 20, 1926 (J. G. Needham).

Limnophila nemoptera belongs to the group of subapterous species hitherto represented in the Western Nearctic fauna by *L. aspidoptera* Coquillett (New Mexico) and *L. subaptera* Alexander (California), distinguished by the presence of but

fifteen antennal segments and highly degenerate wings in both sexes, so far as these latter are both known. The present species is well distinguished by its small size and generally pale coloration, with a distinct darker stripe on the abdominal tergites. It is most closely related to *L. subaptera* in having the wings long and narrow, much exceeding the halteres.

Psiloconopa mormon Alexander, new species

Male. Length, about 4-4.5 mm.; wing, 4-5.5 mm. Female. Length about 5-6 mm.; wing, 5 mm.

Described from alcoholic specimens. General coloration brownish black, this including the head and appendages, thorax and abdomen.

Antennæ (♂) relatively elongate, if bent backward extending about to the base of the abdomen; flagellar segments elongate-oval, becoming shorter outwardly, the terminal segment abruptly smaller.

Halteres pale. Legs black, the femoral bases restrictedly paler. Wings of normal length and width, tinged with grayish brown, the stigmal region very faintly darker; veins dark brown. Venation: Sc_1 ending shortly beyond the fork of *Rs*, Sc_2 not apparent; *Rs* elongate; *r* a little more than its own length beyond the origin of R_2; cell *1st* M_2 open by the atrophy of *m*; cell M_3 about twice its petiole; vein *2nd A* straight, relatively long, ending opposite the origin of *Rs*.

Male hypopygium with the basistyles relatively short and stout, their outer faces only sparsely setiferous, the mesal faces densely provided with setæ. Outer dististyle gently arcuated, with a blunt spine on margin before midlength. Inner dististyle a little more than one-half the length of the outer, stout, straight, the outer face densely set with erect to subretrorse setæ. Gonapophyses longer than the ædeagus, nearly straight, their tips a little incurved. Ædeagus subtended on either side by a broad flange that becomes narrower outwardly.

In the female the antennæ are shorter, the outer flagellar segments short-oval. Legs shorter and stouter.

Holotype, ♂, **Logan River, Utah,** altitude about 5500 feet, June 23, 1926 (J. G. Needham). Allotopotype, ♀. Paratypes, 5 ♂ ♀.

A small group of dark-colored Eriopterini that have been placed hitherto in *Erioptera* are now transferred to the genus *Psiloconopa* Zetterstedt, the members of which until now were recognized only from the Palæarctic Region. The genus is still poorly understood, and in the European fauna rather discordant elements have been associated in the group. The late Doctor Bergroth and other authorities considered *Psiloconopa* to be very close to *Gnophomyia* Osten Sacken, but Crampton's very

important work on the thoracic sclerites of the Eriopterine Tipulidæ (Insec. Inscit. Menst., 13: 197-213; 1925), has shown the genus to be most closely allied to *Erioptera,* of which it may eventually be held to constitute only a subgenus. The Nearctic species, all western in distribution, that have been described as species of *Erioptera* but apparently refer to the present group are as follows: *P. laticeps* Alexander (California), *P. pilipennis* Alexander (Oregon), and a group of arctic and subarctic species from Alaska and the Canadian northwest; *P. angustipennis* Alexander, *P. katmai* Alexander, *P. alaskensis* Alexander, and *P. aldrichi* Alexander.

The White-Lined Sphinx

The white-lined sphinx, *Celerio lineata* (Fabr.), is often abundant in the desert areas of southern California. I have repeatedly taken great numbers of the adults about lights, but not until last spring did I run across the larvæ in such abundance. After turning on to the Palm Springs highway at White Water, and continuing across the Southern Pacific railroad beyond Palm Springs station, the caterpillars were observed crossing the macadam highway in increasingly greater numbers as far as the bridge which crosses the wash near the hills, beyond which none was to be found. In examining the infested area the larvæ were everywhere and literally swarmed over the sand.

They varied in length from two inches to five inches. The black and orange color phase greatly predominated, and only rarely could the black and green individuals be found. Many of them were very restless and were crawling about over the hot sand in great haste. Those which attempted to cross the smooth road were rolled over and over long distances by a strong wind, but as soon as they regained their feet they were off again and as often in the opposite direction. All threw themselves violently and exuded an abundance of green excrement when touched, so that the large jarful that I brought home was collected by means of a stick and a tin can.

They were feeding chiefly upon a desert primrose (*Œnothera* sp.) which was abundant at that season (March 30, 1926). All of these plants were either partially or entirely defoliated. They were also observed to feed on locoweed (*Astragalus* sp.) and desert malva (*Sphæralcea ambigua* Gray?).—E. O. Essig.

FOUR NEW DOLICHOPIDS IN THE COLLECTION OF THE CALIFORNIA ACADEMY OF SCIENCES

BY M. C. VAN DUZEE
Buffalo, New York

Paraclius magnicornis Van Duzee, new species

Male. Length, 2.2 mm. Face narrow, silvery white. Palpi black. Front green, dulled with brownish pollen. Antennæ black; third joint large, twice as long as wide, rounded at tip, arista inserted near its base.

Thorax and abdomen green; pleuræ and sides of abdomen with thick white pollen. Hypopygium black, long and slender, its lamellæ small, oval, a little longer than wide, pale brown with the edges blackish, fringed with a few black hairs.

All coxæ, femora, tarsi and the hind tibiæ black; extreme tips of coxæ and the trochanters yellow; anterior tibiæ yellow, middle ones dark yellowish; hairs and bristles of coxæ black. Tarsi plain; joints of fore tarsi as 16-5-5-4-5; first two joints of middle ones as 26-19; those of posterior pair as 22-26-21-14-9. Calypters and halteres yellow, the former with black cilia.

Wings dark grayish, veins black; costa not at all thickened; bend in last section of fourth vein beyond the tip of the fifth vein; last section of fifth vein 22, cross-vein 9/50 of a millimeter long.

Type, male, No. 1881, Mus. Calif. Acad. Sci., taken by C. L. Fox, July 20, 1925, at **Lewiston, Idaho.**

A very small species with black legs, very slender hypopygium, small oval lamellæ and large, oval third antennal joint.

Paraclius keiferi Van Duzee, new species

Male. Length, 4 mm. Face and palpi covered with white pollen, face wide. Front nearly opaque with brown pollen, the ground color green. Antennæ black, third joint small, nearly round, scarcely pointed at tip. Lateral and inferior orbital cilia white.

Thorax green with three bronze brown vittæ on the dorsum, the median one distinct and reaching the scutellum, which is bronze colored; pleuræ with thick white pollen. Abdomen blue-black with black incisures and abundant white pollen on the sides, which extends over the dorsum, leaving a broad median stripe blackish blue. Hypopygium and its lamellæ black, the latter sessil, somewhat pointed at tip, fringed with short yellow hairs. A slender inner appendage inserted near the base of the lamellæ is curved on basal half, widens a little beyond the curve, then tapers to a point, apical part fringed with very short hair, this appendage extends nearly to the tip of the lamellæ.

Coxæ, femora and tibiæ blue-black, tarsi black; fore and middle tibiæ without a bristle below, the former with only small, the latter

with strong bristles above; tarsi with a little spine at the tip of each joint. Joints of fore tarsi as 26-9-6-5-8; those of posterior pair as 28-26-20-17-12. Calypters and halteres yellow, the former with black cilia.

Wings dark grayish, tinged with brown, especially in front; costa not at all thickened; last section of fifth vein a little shorter than the cross-vein; bend in last section of fourth vein the length of the cross-vein beyond that vein.

Female. Like the male in form and color of head, thorax, legs, and wings; abdomen more steel-blue.

Type, male, No. 1882, Mus. Calif. Acad. Sci., taken by H. H. Keifer, June 4, 1925, on **Cedros Island, Lower California;** allotype, female, No. 1883, Mus. Calif. Acad. Sci., and four paratypes taken at the same time and place.

Rhaphium (Xiphandrium) æqualis Van Duzee
new species

Male. Length, 3 mm. Face moderately wide, silvery white. Palpi black. Front violet. First antennal joint black (other joints missing in type). Orbital cilia white.

Thorax and abdomen green with bronze and coppery reflections; hair on upper surface of abdomen black, that on the sides yellow and quite long. Hypopygium blackish green with pale hair; its lamellæ elongate triangular, slender, black, fringed with pale hair, with the petiole pale and placed nearly at right angles to apical part. (I can see no inner appendages.)

All coxæ black, anterior pair narrowly yellow at tip and covered with long white hair; middle coxæ with a whitish thorn at tip; all femora and fore and middle tibiæ yellow; upper edge of anterior femora, tip of posterior ones and the whole of hind tibiæ and tarsi black, fore and middle tarsi black with their base yellow; middle femora ciliated with yellow hairs, which are as long as the width of the femora and end in a slender black bristle; first joint of fore tarsi very slightly widened at tip; joints of fore tarsi as 24-10-8-7-5; those of middle pair as 30-15-8-3-5; joints of posterior pair as 26-25-20-15-9. Calypters, their cilia and the halteres pale yellow.

Wings grayish, tinged with brown in front of third vein, which is bent backward at tip so as to approach fourth vein, the latter ending in the apex of the wing; last section of fifth vein twice as long as the cross-vein.

Type, male, No. 1884, Mus. Calif. Acad. Sci., taken by C. L. Fox, July 25, 1925, at **Moscow, Idaho.** This is very much like *triangulatum* Van Duzee, but differs in having the hypopygial lamellæ black, hind tibiæ wholly deep black and the first and second joints of hind tarsi of very nearly equal length.

Dolichopus oregonensis Van Duzee, new species

Male. A bright green species with blue reflections, black hypopygial lamellæ and black femora. Length, 5 mm.

Face rather narrow, silvery white, a little yellowish on upper half. Palpi black with black hair. Antennæ wholly black, third joint about as long as wide, a little pointed at tip. Front blue or blue-green. Orbital cilia wholly black.

Abdomen with more blue than the thorax, both without pollen. Hypopygium blue-black, rather long; its lamellæ quite large, somewhat crescent-shaped as in Gymnopternus, middle of the outer edge with two large branched bristles, brown with the edges and apical half black.

Coxæ, femora, tibiæ and tarsi wholly black; hairs and bristles of coxæ black; hind femora ciliated with long hairs on lower posterior edge, these hairs scarcely as long as the width of the femora, appearing pale in certain lights; fore tibiæ with two bristles near the middle of lower posterior edge; middle tibiæ with one bristle beyond the middle of lower surface; fore tarsi as long as their tibiæ, their first joint as long as the four following taken together; middle tarsi with first joint as long as the following three together and without a bristle; first and second joints of hind tarsi of nearly equal length. Calypters black at base, dark yellow apically, with black cilia; knobs of halteres yellow; petiole black.

Wings dark grayish; costa with a very slight enlargement at tip of first vein; bend in last section of fourth vein moderate, nearly opposite tip of fifth vein; hind margin of wing not indented at tip of fifth vein; anal angle not very prominent.

Type, male, No. 1885, Mus. Calif. Acad. Sci., taken by C. L. Fox, June 8, 1924, on **Eagle Ridge, Klamath Lake, Oregon.** One paratype was taken at the same place and time.

This would run to *paluster* Melander and Brues, in the table of species in the National Museum Bulletin No. 116, 1921. It differs from that species in having only one preapical bristle on fore and middle femora, the face silvery white, and in the form of the hypopygial lamellæ. It also differs from *fortis* Aldrich, which would run to the same species, in having the face silvery white and in the form of the lamellæ. In both *paluster* and *fortis* the face is yellowish brown or brownish, but *fortis* has only one preapical bristle, while *paluster* has two.

A CORRECTION

Professor Cockerell calls attention to an error on page 80 of the Pan-Pacific Entomologist, where the name *Panurgus melanocephalus* should read *Panurginus melanocephalus*.

NOTES ON A TRIP TO ENGLAND

BY C. L. FOX

The following is an entomological outline of a three months' visit to England in the summer of 1926 where I collected in many districts and came into contact with several interesting British entomologists. This I was enabled to do through the kind hospitality and aid of members of my family circle.

I left San Francisco on June 20. Stopping over at Chicago I called at the Field Museum, meeting Mr. William J. Gerhard, Mr. A. B. Wolcott and Mr. E. Liljeblad and, through their courtesy, being given an opportunity to examine the Bembicine wasps of that collection. On June 26 I sailed from New York, landing at Plymouth on July 3.

At the rooms of the Entomological Society of London, I met Mr. W. G. Sheldon, treasurer, who procured for me a permit from the National Trust to enter the Wicken Fen Reserve in Cambridgeshire, where later I spent four enjoyable days collecting. At the rooms of this society I also met Mr. H. J. Turner, who kindly gave me information I required on certain matters.

At the British Museum (Natural History) at South Kensington, I met Dr. C. J. Gahan, director of the entomological department, and Dr. James Waterston, head of the department of Hymenoptera, who showed me the large and excellent collections of Nomada bees and Bembicine wasps from all over the world, and gave me many of Mr. R. E. Turner's papers on the latter group. In other departments I had an interview with Mr. C. J. Arrow and Mr. F. Laing, both of whom kindly agreed to enter into correspondence and exchange, the former with Mr. E. R. Leach in Scarabiidæ and Lucanidæ, and the latter with Mr. Dudley Moulton in Thrips.

Passing through Hertfordshire, I called upon Dr. K. Jordan at the Tring Museum, meeting also the owner, Lord Rothschild. On a second visit the following month, Doctor Jordan gave me another interesting time, showing me certain wonderful groups of the Lepidoptera collected from all over the world, and the late Hon. N. C. Rothschild's noted flea collection, now owned by the British Museum.

The Rev. F. D. Morice, a leading hymenopterist, inviting me to his home at Woking, Surrey, showed me his fine collection, from which I obtained useful information regarding his work on the Tenthredinids, Nomadas, and Bembicids. Three weeks later I was sorry to hear that he had died.

With Dr. C. L. Perkins at Newton Abbot, Devon, I spent an interesting afternoon. Doctor Perkins was formerly head of the entomological department of the Hawaiian Sugar Planters' Association, and a co-worker with the late Albert Koebele in the introduction of parasites on insects pests. He showed me his excellent collection of Hymenoptera, also one made by the late Frederick Smith, author of the Catalogue of the Hymenoptera of the British Museum, and gave me many named British species and determined for me specimens I had taken, all of which have been placed in the entomological department of the California Academy of Sciences. He also discussed with me important structural characters for separating species of the Hymenoptera. He also gave me interesting accounts of his observations on life histories of bees.

In London I lunched with Mr. R. S. Bagnall and had an interesting talk with him on Thrips. He gave me a number of his determined specimens and some papers by him to take back to Mr. Dudley Moulton.

At Plymouth, my home town, I made friends with Mr. Charles W. Bracken, a dipterist, Mr. James H. Keys, a coleopterist, and Dr. Hem Sing Pruthi, an hemipterist. The former two kindly identified specimens I had collected and gave me named material from their collections, the latter offered to secure material in India for Mr. E. P. Van Duzee and Mr. Dudley Moulton of San Francisco.

At the suggestion of Mr. E. P. Van Duzee I spent as much as possible of my spare time while in England collecting insects for the California Academy of Sciences. My best collecting was in Herefordshire, in the New Forest, Hampshire, in South Devon and on the Wicken Fen Reserve. This latter locality is owned by the National Trust, an association for the retention of places of historical and other interests in England. This natural marsh area of about 300 acres is reserved for persons interested in natural history, especially in entomology.

Owing to cold and wet conditions during former years the Hymenoptera, excepting bumblebees and Vespids, were scarce. I took no members of the two groups on which I am working, the Bembicine wasps and Nomada bees. The former, I was told, had never been found in the British Isles, whilst for the latter I was too late, but through the generosity of Dr. R. C. L. Perkins I was enabled to bring back fourteen of the twenty-eight British species of Nomada.

REINFORCED GENERIC NAMES

In a recent number of the American Naturalist our able collaborator, Dr. E. P. Felt, has suggested a system of initial letter prefixes for generic names employed in zoology, the use of which it is intended shall not only assist the memory, but would classify the names as well. We cannot but feel that our good friend is unduly exercised over the multiplicity of generic names. To the systematist this plethora of names causes little inconvenience. Should the worker in applied entomology, however, find the constant splitting up of the older genera to be confusing he has a sure remedy right at his hand: let him use the older generic concepts only. Should he so elect he can use these new names as they are split off, as subgenera, or ignore them altogether. Such a course would in no way detract from the value of his records or make them less intelligible to the systematist.—E. P. Van Duzee.

NOTE

Coccotrypes dactyliperda Fab.—This seed-infesting Scolytid beetle, which is a native of Africa and Asia, and breeds in the seeds of the date and betelnut and as a result been carried to various parts of the world, was recently (October 1, 1926), found in Los Angeles, California, to be infesting the seeds of the ornamental Canary Island palm, *Phœnix canariensis*. The seeds were collected by Mr. Frank Walters and submitted to me by Mr. H. M. Armitage of the Los Angeles County Horticultural Commissioner's office. It is to be hoped that they will not establish themselves in the date groves of the Coachella Valley.—Edwin C. Van Dyke.

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On February 22, 1927, Mr. Louis S. Slevin of Carmel, California, presented to the California Academy of Sciences his valuable collection of beetles under conditions similar to those under which the Academy received the Van Dyke and Blaisdell collections. Mr. Slevin is retaining for reference at his home a representative series of certain of the species found about Carmel to assist him in further studies on those and related forms. Mr. Slevin's collection is the fruit of many years of careful collecting in Monterey County, biologically one of the most interesting in California. This collection, estimated to contain over 20,000 specimens, will make a most valuable addition to the Academy's collection of insects.

It is with sincere regret that we chronicle the death of Mr. J. C. Huguenin, which occurred at his home in San Francisco, December 7, 1926. Mr. Huguenin was born at Chaux-de-Fonds, Switzerland, December 20, 1840, so at the time of his death he was almost 86 years of age. From his youth he was a lover of Nature, his chief interest in his earlier years being more particularly in the birds. His work in entomology began in the collection of butterflies about San Francisco, and led to his becoming a member of the California Entomological Club (later the Pacific Coast Entomological Society) at its second meeting on November 15, 1901. From that time on his interest in the Society and its objects never flagged. About a year ago Mr. Huguenin gave to the Academy all his collection of insects excepting the butterflies, in which he retained an active interest to the last. A fuller sketch of Mr. Huguenin's life will be published in the next number of the Proceedings of the Pacific Coast Entomological Society.

Correspondents of Mr. J. O. Martin will kindly note that he has recently removed to 2617 Derby Street, Berkeley, California. He expects to start about the middle of April for the "Great Bend" country in southern Texas where he will spend a couple of months collecting insects for the California Academy of Sciences.